

Microplate Strip Washer

ELx50™
Operator's Manual
All Models



ELx50™

Microplate Strip Washer Operator's Manual

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BioTek® Instruments, Inc.

Notices

BioTek® Instruments, Inc.

Highland Park, P.O. Box 998
Winooski, Vermont 05404-0998 USA

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Contact Information

BioTek® Instruments, Inc.

Highland Park, P.O. Box 998
Winooski, Vermont 05404-0998 USA

Customer Service and Sales

Internet: www.bioteck.com
Phone: 888-451-5171 (toll free in the U.S.)
802-655-4740 (outside the U.S.)
Fax: 802-655-7941
E-Mail: customercare@bioteck.com

Service/TAC

Phone: 800-242-4685 (toll free in the U.S.)
802-655-4740 (outside the U.S.)
Fax: 802-655-3399
E-Mail: tac@bioteck.com

European Coordination Center/Authorized European Representative

BioTek® Instruments GmbH
Kocherwaldstrasse 34
D-74177 Bad Friedrichshall
Germany
Internet: www.bioteck.de
Phone: +49 (0) 7136 9680
Fax: +49 (0) 7136 968 111
E-Mail: info@bioteck.de

Document Conventions

This manual uses the following typographic conventions:

Example	Description
	This icon calls attention to important safety notes.
Warning!	A Warning indicates the potential for bodily harm and tells you how to avoid the problem.
Caution	A Caution indicates potential damage to the instrument and tells you how to avoid the problem.
DEFINE	Text in COURIER font represents menu options as they appear on the instrument's display.
Note:	Bold text is primarily used for emphasis.
	This icon calls attention to important information.

About This Manual

The intent of this Operator's Manual is to instruct the new user how to set up and operate BioTek's ELx50™. To help you read and understand this manual, certain document conventions have been used.

Major topic headings start a new page (such as **Document Conventions**, above) to give you a visual and style clue that a new major subject is being introduced. One or more subheadings may appear below each major heading.

Revision History

Revision	Date	Changes
A	6/97	First Issue.
B	9/97	Added valve tubing connection diagram. Corrected rear panel figure.
C	4/99	Updated menu sequences, addresses.
D	4/99	Revised operator's manual to reflect BOM revision.
E	6/99	Added support for 16-channel manifold/384-well plates.
F	3/01	Revised Chapter 4 maintenance procedures; removed Appendix B, Performance Verification, and added it to Chapter 4. Added a log to record maintenance.
G	10/03	Updated Notices to include current company contact information. Updated Safety Symbols and Intended Use. Added Chemical Compatibility information to Precautions. Updated Warranty to include Bio-Tek's current warranty statement. Changed operating environment temperature range from 15°C - 30°C to 15°C - 40°C. Added Registration Card information. Clarified bleach dilutions for Decontamination.
H	2/04	Reformatted entire manual according to new template. Changed selectable ranges for the following throughout manual to conform to software specs: Prime Volume from 1 to 999 ml to 1 to 200 ml; Shake Duration from 0 to 600 seconds to 1 to 600 seconds, Bottom Dispense Volume from 25 to 3000 µl/well to 50 to 3000 µl/well. Updated introductory material, enhanced Hardware Features, Package Contents, and Optional Accessories. Corrected specs for physical dimensions and storage and operating temperatures. Updated contact information, enhanced Unpacking and Packing instructions with new text and 14 new figures. Enhanced Operation chapter with new sections: Keypad Description, System Startup, Main Menu, and Utility. Added new Defaults and Ranges tables for Wash Method, Wash Dispense, Wash Aspirate, and Prime Programs. Restructured Chapter 4, Maintenance and Performance Verification for continuity, enhanced Decontamination section, updated Liquid Testing section. Enhanced/updated Troubleshooting and Error Codes. Added two new appendices C, Chemical Compatibility, and D, Default Programs.
I	2/07	Added instructions and information in all chapters of the manual for the aspiration carrier (ELx50™/8FMW model). Removed hyphen from "Bio-Tek" ("BioTek") and changed "ELx50 Automated Strip Washer" to "ELx50 Microplate Strip Washer." Replaced the previous cover with new cover design from Marketing. <i>Cont'd on next page</i>

Revision	Date	Changes
		<p>Updated regulatory/safety information and removed Warranty and Registration Card sections in the Preface. Revised ranges for prime flow rate, dispense flow rate, bottom flow rate, and dispense volume for the 12-channel manifold in Chapter 3, to reflect recent revisions in the washer's software. Revised instructions for flushing BSA in Chapter 4. Incorporated manual update H2: added dispense volume ranges for 96- and 384-well plates for the 16-channel manifold in Chapter 3 and in Appendix A, and revised the Recommended Maintenance/Performance Verification Schedule in Chapter 4 by moving the Liquid Tests from the IQ to the Initial/Annual OQ and monthly PQ.</p>
J	4/07	<p>Revised Chapters 1 through 5 primarily to support a redesign of the aspiration carrier in the ELx50/8FMW washer: the vacuum grate is now secured in place (under the plate seal gasket) by six screws around the perimeter of the top of the carrier. Also revised vacuum levels for the aspiration carrier: from -240 mmHg to -64 mmHg for the 0.047" diameter hole of the carrier's vent port, and from -64 mmHg to -240 mmHg for the 0.020" diameter hole in the black vent plug.</p>
K	10/07	<p><i>General.</i> Added information on the Liquid Level Alert™ option, which is available for all ELx50 models. Added information on the new 'First Strip' run-time parameter. Additional cleanup and clarifications as described below.</p> <p><i>Chapter 1, Introduction. Software Variations:</i> Clarified which features and functions are supported for the different basecode part numbers. <i>Hardware Features:</i> Simplified the description of the supply and waste bottles provided with the instrument. <i>Optional Accessories:</i> Added information on Liquid Level Alert option.</p> <p><i>Chapter 2, Installation. Connecting Tubes and Bottles:</i> Added information on the Liquid Level Alert option components. Added Liquid Alert port to drawings. Added instructions for connecting the sensor cables to the select box, and the select box to the washer.</p> <p><i>Chapter 3, Operation. Throughout:</i> Added information on the 'First Strip' run-time parameter. Updated Menu Maps.</p> <p><i>General Usage Guidelines:</i> Added section for the Liquid Level Alert option. <i>Linking Programs:</i> Added troubleshooting tip for resolving Link program creation issues. <i>Setup:</i> Added information on new SENSOR option.</p> <p><i>Chapter 4, Maintenance/Performance Verification.</i></p> <p><i>Recommended Maintenance and Performance Verification Schedules:</i> Divided the former Maintenance AND Performance Verification Schedule table into two separate tables.</p> <p><i>Decontamination:</i> Added warning not to prepare a stronger-than-recommended bleach solution.</p> <p><i>Appendix A, Error Codes. General Errors:</i> Added error codes 2800 and 2900, related to the Liquid Level Alert option.</p>

Revision	Date	Changes
L	1/08	<p>General. Added information on the optional vacuum pump muffler for ELx50 washers equipped with the new vacuum pump (washers manufactured after January 2008). Additional changes are described below.</p> <p>Preface. Updated <i>Directives</i> in the CE Mark section and added Unspecified Use Warning to <i>Hazards and Precautions</i>.</p> <p>Chapter 1, Introduction. Added the optional vacuum pump muffler to the <i>Hardware Features and Accessories Included</i> sections. Updated the <i>Performance Specifications</i> section for the 96-well: changed residual volume specs from $\leq 4.0 \mu\text{l}$ to $\leq 2.0 \mu\text{l}$ per well, and dispense precision specs from $\leq 4.0\%$ CV to $\leq 3.0\%$ CV.</p> <p>Chapter 2, Installation. Updated unpacking/packing artwork and instructions to reflect new packaging materials, and added a graphic of the vacuum pump muffler to illustrations of the washer's rear panel.</p> <p>Chapter 4, Maintenance and Performance Verification (IQ/OQ/PQ). In the <i>Evacuation Efficiency and Dispense Precision Tests</i> and <i>Worksheets</i> for the 8-, 8s-, and 12-channel manifolds, changed the residual volume specs from ≤ 0.004 grams per well to ≤ 0.002 grams per well, and the dispense precision specs from $\leq 4.0\%$ CV to $\leq 3.0\%$ CV.</p> <p>Chapter 5, Troubleshooting. In the <i>Troubleshooting Charts</i>, added references to the vacuum pump muffler wherever references to the in-line vacuum filter were present.</p> <p>Appendix B, Manifold Variations. Removed instructions for returning washers to BioTek for reconfiguration to work with another manifold. (The user can perform all the steps necessary to reconfigure the washer for a different manifold.)</p>

Intended Use Statement

- The ELx50™ Microplate Strip Washer provides microplate priming and washing for ELISA™, fluorescence and chemiluminescence immunoassays, cellular and agglutination assays.
- The intended use of this instrument is dependent on the instrument's rear panel label. If there is an IVD label, then the instrument may be used for clinical, research and development, or other non-clinical purposes. If there is no such label, then the instrument may **only** be used for research and development, or for other non-clinical purposes.

Quality Control

It is considered good laboratory practice to run laboratory samples according to instructions and specific recommendations included in the assay package insert for the test to be conducted. Failure to conduct Quality Control checks could result in erroneous test data.

Repackaging and Shipping



If you need to ship the instrument to BioTek for service or repair, contact BioTek for a **Return Materials Authorization (RMA)** number, and be sure to use the original packing. Other forms of commercially available packing are not recommended and can void the warranty. If the original packing materials have been damaged or lost, contact BioTek for replacement packing.

Warnings



Operate the instrument on a flat surface and away from excessive humidity.

When operated in a safe environment according to the instructions in this document, there are no known hazards associated with the ELx50™. However, the operator should be aware of certain situations that could result in serious injury; these may vary depending on the instrument model.

Hazards and Precautions

Hazards



Warning! Power Rating. The ELx50 Microplate Strip Washer's power supply must be connected to a power receptacle that provides voltage and current within the specified rating for the system. Use of an incompatible power receptacle may produce electrical shock and fire hazards.

Warning! Electrical Grounding. Never use a two-prong plug adapter to connect primary power to the ELx50 power supply. Use of a two-prong adapter disconnects the utility ground, creating a severe shock hazard. Always connect the power cord directly to a three-prong receptacle with a functional ground.

Warning! Internal Voltage. Always turn off the power switch and unplug the power supply before cleaning the outer surface of the instrument.

Warning! Liquids. Avoid spilling liquids on the instrument; fluid seepage into internal components creates a potential shock hazard. Wipe up all spills immediately. Do not operate the instrument if internal components have been exposed to fluid.

Warning! Potential Biohazards. Some assays or specimens may pose a biohazard. Adequate safety precautions should be taken as outlined in the assay's package insert. Always wear safety glasses and appropriate protective equipment, such as chemically resistant rubber gloves and apron.

Warning! Unspecified Use. Failure to operate this equipment according to the guidelines and safeguards specified in this manual could result in a hazardous condition.

Warning! Software Quality Control. The operator must follow the manufacturer's assay package insert when modifying software parameters and establishing wash methods, using the washer's onboard software.

Warning! Pinch Hazard. Do not reach under the instrument during operation, as the syringe pump may pinch your fingers.

Precautions

The following precautions are provided to help avoid damage to the instrument:



Caution: Service. The washer should be serviced by BioTek authorized service personnel. Only qualified technical personnel should perform troubleshooting and service procedures on internal components.

Caution: Environmental Conditions. Do not expose the instrument to temperature extremes. For proper operation, ambient temperatures should remain between 15°-40°C (59°-104°F). Performance may be adversely affected if temperatures fluctuate above or below this range. Storage temperature limits are broader (see ***Storing the ELx50*** in ***Chapter 4***).

Caution: Sodium Hypochlorite. Do not expose any part of the instrument to the recommended diluted sodium hypochlorite solution (bleach) for more than 20 minutes. Prolonged contact may damage the instrument surfaces. Be certain to rinse and thoroughly wipe all surfaces.

Caution: Chemical Compatibility - Washers. Some chemicals may cause irreparable damage to washers. The following chemicals have been deemed safe for use in washers: buffer solutions (such as PBS), saline, surfactants, deionized water, 70% ethyl, isopropyl, or methyl alcohol, 40% formaldehyde, and 20% sodium hydroxide. Never use acetic acid, DMSO, or organic solvents. Other chemicals may cause severe damage to the instrument. Contact BioTek prior to using any other chemicals. Refer to ***Appendix C, Chemical Compatibility***.

Caution: Washers and Wash Buffer Solution. Although many precautions have been taken to ensure that the instrument is as corrosion-proof as possible, the washer is not sealed and liquids can seep into sensitive components. Make sure that any spilled wash buffer solution is wiped off the washer. Prolonged exposure to salt solution may corrode parts of the carrier, movement rail, springs, and other hardware.

Caution: Bovine Serum Albumin. Solutions containing proteins, such as bovine serum albumin (BSA), will compromise the washer's performance over time unless a strict maintenance protocol is adhered to. See ***Chapter 4, Maintenance and Performance Verification (IQ/OQ/PQ)*** for cleaning instructions regarding BSA.

Caution: Warranty. Failure to follow preventive maintenance protocols may **void the warranty**. See ***Chapter 4***.

Caution: Disposal. This instrument contains printed circuit boards and wiring with lead solder. Dispose of the instrument according to Directive 2002/96/EC, "on waste electrical and electronic equipment (WEEE)."



Based on the testing described below and information contained herein, this instrument bears the CE mark.

Directive 2004/108/EC: Electromagnetic Compatibility

Emissions - CLASS A

EN 50081-1 and IEC 61326-1

EN 55022 Class A

Immunity

EN 50082-1 and IEC 61326-1

IEC 1000-4-2 Electrostatic Discharge

IEC 1000-4-3 Radiated EM Fields

IEC 1000-4-4 Electrical Fast Transient/Burst

IEC 1000-4-5 Surge Immunity

EN 61000-4-6 Conducted Disturbances

EN 61000-4-11 Voltage Dips, Short Interruptions and Variations

Directive 73/23/EEC Low Voltage

EN 61010-1: "Safety requirement for electrical equipment for measurement, control and laboratory use. Part 1, General requirements."

Directive 2002/96/EC: Waste Electrical and Electronic Equipment

Disposal Notice

This instrument contains printed circuit boards and wiring with lead solder. Dispose of the instrument according to Directive 2002/96/EC, "on waste electrical and electronic equipment (WEEE)."

Directive 98/79/EC: In Vitro Diagnostics (some models)

- Product registration with competent authorities
- Traceability to the U.S. National Institute of Standards and Technology (NIST): Dispense precision and average residual volume is traceable to NIST.

Specific data for a particular serial number is available upon request from BioTek Instruments. See page ix for contact information.

Electromagnetic Interference and Susceptibility

USA FCC CLASS A

Warning: Changes or modifications to this unit not expressly approved by the manufacturer could **void the user's authority** to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. Like all similar equipment, this equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause interference, in which case the user will be required to correct the interference at his own expense.

Canadian Department of Communications Class A

This digital apparatus does not exceed Class A limits for radio emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numerique de la Class A prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

User Safety

This device has been type tested by an independent laboratory and found to meet the requirements of the following:

North America

- **Canadian Standards Association CAN/CSA C22.2 No. 61010-1-04**
“Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements.”
- **Underwriters Laboratories UL 61010-1:2004**
“Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements.”

International

- **EN 61010-1**
“Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements.”

Safety Symbols



Alternating current

Courant alternatif
Wechselstrom
Corriente alterna
Corrente alternata



Direct current

Courant continu
Gleichstrom
Corriente continua
Corrente continua



Both direct and alternating current

Courant continu et courant alternatif
Gleich- und Wechselstrom
Corriente continua y corriente alterna
Corrente continua e corrente alternata



Earth ground terminal

Borne de terre
Erde (Betriebserde)
Borne de tierra
Terra (di funzionamento)



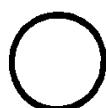
Protective conductor terminal

Borne de terre de protection
Schutzleiteranschluss
Borne de tierra de protección
Terra di protezione



On (Supply)

Marche (alimentation)
Ein (Verbindung mit dem Netz)
Conectado
Chiuso



Off (Supply)

Arrêt (alimentation)
Aus (Trennung vom Netz)
Desconectado
Aperto (sconnessione dalla rete di alimentazione)



Caution (refer to accompanying documents)

Attention (voir documents d'accompagnement)

Achtung siehe Begleitpapier

Atención (vease los documentos incluidos)

Attenzione, consultare la doc annessa



Warning, risk of electric shock

Attention, risque de choc électrique

Gefährliche elektrische Schlag

Precaución, riesgo de sacudida eléctrica

Attenzione, rischio di scossa elettrica



Warning, risk of crushing or pinching

Attention, risque d'écrasement et pincement

Warnen, Gefahr des Zerquetschens und Klemmen

Precaución, riesgo del machacamiento y selección

Attenzione, rischio di schiacciare ed intrappolarsi



Warning, hot surface

Attention, surface chaude

Warnen, heiße Oberfläche

Precaución, superficie caliente

Attenzione, superficie calda



Consult instructions for use

Consulter la notice d'emploi

Gebrauchsanweisung beachten

Consultar las instrucciones de uso

Consultare le istruzioni per uso



***In vitro* diagnostic medical device**

Dispositif médical de diagnostic *in vitro*

Medizinisches *In-Vitro*-Diagnostikum

Dispositivo médico de diagnóstico *in vitro*

Dispositivo medico diagnostico *in vitro*



Separate collection for electrical and electronic equipment

Les équipements électriques et électroniques font l'objet d'une collecte sélective

Getrennte Sammlung von Elektro- und Elektronikgeräten

Recogida selectiva de aparatos eléctricos y electrónicos

Raccolta separata delle apparecchiature elettriche ed elettroniche

Chapter 1

Introduction

This chapter introduces the ELx50™ Microplate Strip Washer, and describes its hardware and software features and technical specifications. Instructions on how to contact BioTek for Product Support & Service are included on page 12.

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Introducing the ELx50 Microplate Strip Washer

Fast, versatile, and easy to use, the ELx50™ is a user-programmable, fully automated microplate strip washer. Its key features include the following:

- The precision syringe pump with its long-lasting seal ensures precise fluid delivery, as well as reproducibility from wash to wash.
- Programmable dispense volumes, flow, and height, and aspiration rates and depths provide for a wide range of washing capabilities, from gentle washing for cellular assays to vigorous washing for ELISA™.
- The optional bottom washing routine can be applied to lower the background absorbance. The optional crosswise aspiration routine can be applied to reduce residual volumes.
- The ELx50 can be used to wash all microplate-based assays, including ELISA, fluorescence, chemiluminescence, RIA, DNA probes, and cellular assays.
- The intuitive menu-driven software allows you to create and store up to 75 washer programs. When you are ready to run a program, simply select the program name and follow the screen prompts. The ELx50 will then process the plate according to the program parameters.
- All ELx50 models support Wash, Prime, Dispense, and Aspirate programs. Some models also support Soak and Link programs.
- Several pre-defined programs are provided to simplify preventative maintenance, which should be performed regularly to ensure optimum washer performance.
- All ELx50 models can be used to wash standard 96-well microplates, and some models are also equipped to wash standard 384-well microplates.
- “V” versions of the ELx50 feature automatic wash buffer switching with three valves.
- The Liquid Level Alert™ option allows users the convenience of continuous monitoring for both supply and waste bottles. At the beginning and end of a wash protocol, the liquid level is verified to ensure sufficient wash buffer remains in the designated dispense bottle to complete a microplate wash. Sufficient storage capacity in the waste bottle is also verified. Each Liquid Level Alert kit includes a quantity of supply and waste bottles with level-sensing capability. Up to three different supply bottles can be connected to the washer through the Liquid Level Alert Select Box.
- An aspiration carrier is provided with the ELx50/8FMW model for bottom aspiration of filter-bottom microplates. A vent port on the carrier and two selectable vent plugs for altering the diameter of the port provide three vacuum levels: low, medium, and high. Plates with filter pore sizes from 0.45 µm to 1.2 µm are supported.

ELx50 Washer Variations

There are several different ELx50™ washer models available: the ELx50/8, ELx50/12, ELx50/16, and ELx50/8FMW.

Each washer comes with one of four possible washer manifolds (8-, 8s-, 12-, or 16-channel positioned above the microplates), and "V" version washers include automatic buffer switching with three valves. All models support the Liquid Level Alert™ option.

The washer manifold, carrier, and software variations are described on the next few pages. For additional information, contact BioTek Instruments (see **Product Support & Service**, page 12).

Manifold Variations

The **manifold** is the washer component positioned above the microplate that delivers fluid to, and removes it from, the microwells. Each ELx50 washer is equipped with a manifold containing 8, 12, or 16 sets of aspirate and dispense tubes, or "channels." The following table shows the washing capabilities of each manifold:

With this manifold:	You can wash:
8-channel	8-well strips, 96-well plates
8s-channel	8-well strips, 96-well plates
12-channel	12-well strips, 96-well plates
16-channel	8-well strips, 96-well plates, 384-well plates

The ELx50 supports the washing of standard flat, round, and 'V' bottom microwells; the ELx50/8FMW model also supports bottom aspiration of filter-bottom plates.

The ELx50 *can* be reconfigured to support a different manifold. See **Appendix B, ELx50 Manifold Variations** for more information.

- ❖ The 8s-channel manifold has shorter dispense tubes for special applications.
- ❖ The 16-channel manifold uses two aspirate tubes for each well when used with 8-well strips and 96-well plates. For these formats, it may be difficult for the tubes to reach the very bottom of round or 'V' bottom wells, possibly leading to higher residuals.
- ❖ The ELx50/8FMW model does not support the 16-channel manifold.

Patented Dual-Manifold Design

The patented Dual-Action™ 16-channel manifold has 16 sets of dispense and aspirate tubes arranged in a fixed horizontal position relative to each other but located in two separate manifolds (see **Figure 1** below). The two manifolds move independently of each other on the vertical axis. This dual-manifold design overcomes the problem of fitting both a dispense and an aspirate tube into the much smaller 384-well at the same time, yet it allows for overfill washing of the smaller 384 wells. The dispense tubes are held above the plate when the dispense manifold reaches a mechanical stop, while the aspirate tubes are able to continue descending into the wells.

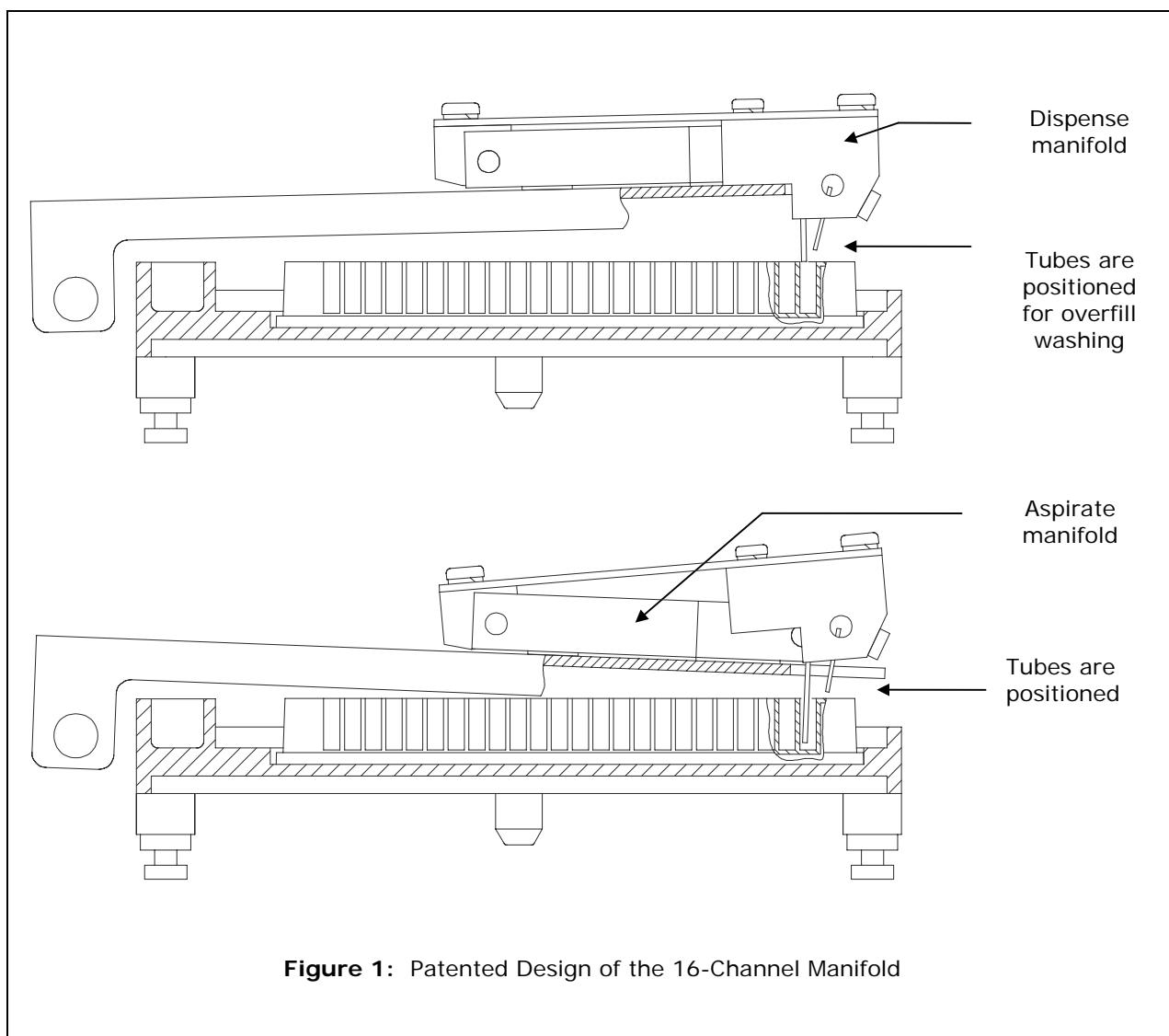


Figure 1: Patented Design of the 16-Channel Manifold

Carrier Variations

The **carrier** is the washer component that transports microplates and positions the wells underneath the manifold tubes. There are three possible carrier types, and their usage depends on the manifold type installed and the microplate type being used:

- Microplate carrier that supports 8-, 8s-, and 12-channel manifolds and solid-bottom plates.
- Microplate carrier that supports 16-, 8-, and 8s-channel manifolds and solid-bottom plates.
- “Aspiration carrier” that supports 8- and 8s-channel manifolds and 96-well filter-bottom plates. This carrier is used on ELx50/8FMW model *only*, and aspirates fluid from below the microplates, so that fluid is drawn down through the filters at the bottom of the wells.

The basecode software onboard the ELx50/8FMW has been pre-configured to use either the microplate carrier or the aspiration carrier. The aspirate-only program parameters ASPIRATE TYPE and BOT ASPIRATE TIME only appear if the washer model is the ELx50/8FMW, and the manifold is configured as either 8- or 8s-channel.

Software Variations

The ELx50™ washer is operated by onboard software, controllable through the washer’s keypad. This onboard software, referred to as the “basecode,” has an identifying **part number**.

Your washer is installed with one of three possible ELx50 basecode part numbers: 4070230, 4070261, or 4070201. Each part number in turn has an identifying **version number**. If you need to contact BioTek Instruments for technical assistance, you will be asked for the part number and version of the basecode currently residing on your washer. See **Product Support & Service**, page 12, for instructions for retrieving this information from the washer.

The **4070230** basecode supports:

- Compatibility with the 8-, 8s-, 12, and 16-channel manifolds. The 16-channel manifold supports both 96- and 384-well plate washing.
- An easy to use, menu-driven interface.
- Ability to create Wash, Prime, Dispense, Aspirate, Soak, and Link programs for automated microplate washing.
- Storage of up to 75 washer programs.
- User-definable washer program names, for rapid recall at program run time.
- Configurable program parameters such as variable soaking, multispeed shaking, bottom washing, and crosswise aspiration.
- Pre-defined washer programs that can be copied and used as the basis for new programs.

- Pre-defined maintenance programs, including AutoPrime, used to keep the manifold tubes moist and free from clogging.
- Support for the following languages: English, French, German, Italian, and Spanish.

❖ **Note:** Contact BioTek for information on changing to a different language.

- Compatibility with the ELx50/8FMW washer's aspiration carrier, for bottom aspiration of 96-well filter-bottom plates. Note: The 16-channel manifold cannot be used with the aspiration carrier.
- Compatibility with the Liquid Level Alert™ option.

The **4070261** basecode supports the above features, but it is not compatible with the Liquid Level Alert option and does not support the 16-channel manifold with the ELx50/8FMW washer's aspiration carrier.

The **4070201** basecode is not compatible with the 16-channel manifold, the Liquid Level Alert option, or the ELx50/8FMW washer's bottom aspiration carrier. This basecode does not provide the ability to create Soak or Link programs.

Hardware Features

- 2-line x 24-character LCD display.
- Membrane keypad with 25 alphanumeric keys.
- Washes:
 - 96-well microplates with 0.355" / 9 mm well centers
 - 384-well microplates with 0.177" / 4.5 mm well centers (washer model-dependent)
 - 96-well filter-bottom microplates (ELx50™/8FMW model only)
 - 1 x 8 or 1 x 12 microwell strips
- Crosswise aspiration for optimizing washing performance.
- External 24-volt power supply.
- One serial RS-232 COM port (25-pin male connector).
- Supply and waste systems appropriate for the model/purchased options.
- Internal positive displacement pump provides controllable flow rates and volumes to make washing cellular assays and immunoassays equally convenient. Settings are adjustable via the onboard software, for low to high velocity dispensing.
- Internal vacuum pump aspirates liquid from the microwells into the waste collection vacuum vessel.
- Stepper motors provide accurate and repeatable carrier and manifold positioning.
- Accommodates 1 x 8, 1 x 12, or 1 x 16 manifolds. See **Appendix B, ELx50 Manifold Variations** for more information.
- Flat, round and 'V' bottomed strips and plates are washed.
- Carrier and manifold are easily removed for cleaning.
- Priming/soaking trough built into the carrier.
- Five shaking speeds for more intense washing.
- Programmable aspiration depth: Ensures that the tubes do not touch the well bottom, allowing the handling of sensitive cell assays.
- ELx50/8FMW model: one vent port (0.047" in diameter) on the aspiration carrier and two selectable vent plugs (with 0.032" and 0.020" diameter holes) for varying the amount of vacuum used with the aspiration carrier.
- Mist shield protects the microplate from contaminants.

Accessories Included

- 24 VDC power supply (PN 61062)
- Power cord (part number varies according to country of use)
- 8-, 8s-, 12-, or 16-channel manifold
- Microplate carrier (specific to manifold type)
- Aspiration carrier (ELx50™/8FMW model only) with two vent plugs:
 - One plug with 0.032" diameter hole (PN 4072100)
 - One plug with 0.020" diameter hole (PN 4072099)
- Mist shield (PN 4070517)
- Two 2-liter supply bottles (three with "V" version washers) (PN 4070515)
- One 2-liter waste bottle (PN 48140)
- Waste tubing set:
 - All models except ELx50/8FMW (PN 4070511)
 - ELx50/8FMW model only (PN 4073002)
- Supply tubing set (PN 4070510)
- Optional in-line vacuum filter (PN 48146)
- Optional vacuum pump muffler (PN 4073009) for ELx50 washers that are equipped with the new vacuum pump (washers manufactured after January 2008)
- Stylus maintenance kit (PN 4070523)
- Operator's Manual (PN 4071000)
- Packing instructions (PN 4071015)
- Set of shipping materials (PN 4073001)
- Shipping document (PN 94075) that includes a Warranty Statement and Certificate of Compliance and Calibration
- Declaration of Conformity (PN 4071006 for clinical models or PN 4071034 for non-clinical models)

❖ Part numbers are subject to change over time. Please contact BioTek Customer Care if you have any questions.

Optional Accessories

- 8-channel manifold (PN 4070512)
- 8s-channel manifold (PN 4070519)
- 12-channel manifold (PN 4070513)
- 16-channel manifold (PN 4070527)
- Liquid Level Alert™ option:
 - PN 4070035, for non-“V” version washers: Liquid Level Alert select box with 2-liter supply bottle (1) and 2-liter waste bottle (1), with sensors
 - PN 4070036, for “V” version washers: Liquid Level Alert select box with 2-liter supply bottles (3) and 2-liter waste bottle (1), with sensors
- Spare vent plugs for aspiration carrier (ELx50™/8FMW model):
 - One plug with 0.032" diameter hole (PN 4072100)
 - One plug with 0.020" diameter hole (PN 4072099)
- Millipore 96-well filter bottom microplates:
 - 0.45 µm filter pore size (Millipore PN MSHVN4550)
 - 1.2 µm filter pore size (Millipore PN's MSBVN1B50 or MSBVN1210)
- RS-232 serial cable (PN 75053)
- In-line vacuum filter replacement (PN 48146)
- BioTek blue test dye solution (PN 7773001) and wetting agent solution (PN 7773002) for liquid testing
- Installation-Operational-Performance Qualification (IQ-OQ-PQ) package (PN 4070530)
- ELx50 Service Manual (PN 4071008)

❖ Part numbers are subject to change over time. Please contact BioTek Customer Care if you have any questions.

Specifications

Microplates

- Microplates: 96-well, 384-well solid-bottom plates and 96-well filter-bottom plates, 0.45 μ m to 1.2 μ m filter pore size (ELx50TM/8FMW)
- Microstrips: 1 x 8, 1 x 12
- Microwells: Flat, round, or "V" bottom

❖ 384-well support is available with the 16-channel manifold only.

Electrical

- Voltage range: 100 to 250 V~, 50 to 60 Hz
- Power Consumption: 40 W

Physical

- Dimensions: 16 in. D x 14 in. W x 6.5 in. H (40.6 cm x 35.6 cm x 16.5 cm)
- Weight: \leq 20 lbs. (8.9 kg) all models except ELx50/8FMW;
 \geq 22 lbs. (9 kg) ELx50/8FMW model

Environmental

- Operating conditions: 15° - 40°C (59° - 104°F)
- Relative humidity: 10% - 85% (non-condensing)

Hardware

- Manifold type: 8-, 8s-, 12-, or 16-channel manifold, depending on washer model
- Waste bottle volume: 2 liters
- Supply bottle volume: 2 liters
- User interface (LCD): 2 x 24 LCD display; 25 alphanumeric soft keys

Performance Specifications

Residual Volume (Evacuation Efficiency)	
96-Well Performance:	Average residual of \leq 2.0 μ l per well after a 3-cycle wash, when dispensing 300 μ l per well, into a minimum of 4 strips, using a solution of deionized water with 0.1% Tween® 20 or equivalent buffer solution. The aspirate height adjustment should be optimized for the plate prior to testing.
384-Well Performance: (16-channel only)	Average residual of \leq 4.0 μ l per well after a 1-cycle wash, when dispensing 100 μ l per well, into a minimum of 4 strips, using a solution of deionized water with 0.1% Tween 20 or equivalent buffer solution. The aspirate height adjustment should be optimized for the plate prior to testing.
Residual Volume specifications do not apply to the ELx50™/8FMW washer when using the aspiration carrier for filter-bottom plates. Residual Volume specifications are only applicable when using the microplate carrier for solid-bottom plates.	

Dispense Precision	
96-Well Performance:	\leq 3.0% CV when measured over 6 strips from an 8- or 8s-channel manifold, or 4 strips from a 12- channel manifold, dispensing 300 μ l per well of deionized water with 0.1% Tween 20 and colored dye at a rate of 300 μ l per well per second.
384-Well Performance: (16-channel only)	\leq 4.0% CV when measured over 6 strips from a 16-channel manifold, dispensing 100 μ l per well of deionized water with 0.1% Tween 20 and colored dye.

Processing Speed	
96-Well Performance	< 130 seconds for 12 strips (3 cycles, 300 μ l/well, no soak)
384-Well Performance (16-channel only)	< 260 seconds for 24 strips (3 cycles, 100 μ l/well, no soak)

Product Support & Service

All of BioTek's products are backed by a superior support staff. If your instrument ever fails to function perfectly, if you have questions about how to use or maintain it, or if you need to send the instrument to BioTek for service or repair, please contact our Technical Assistance Center (TAC).

Contacting the Technical Assistance Center

Our Technical Assistance Center is open from 8:30 AM to 5:30 PM (EST), Monday through Friday, excluding standard U.S. holidays. You can send a fax or an e-mail any time.

Phone: 800-242-4685 (in the U.S.) or 802-655-4740 (outside the U.S.)

Fax: 802-655-3399

E-Mail: tac@biotek.com

Please be prepared to provide the following information:

- Your name and company information
- A daytime phone or fax number, and/or an e-mail address
- The product name, model, and serial number
- The software part number and basecode version (available via the washer's main menu by selecting UTIL → TESTS → CHKSUM)
- For troubleshooting assistance or instruments needing repair: the specific steps that produce your problem, and any error codes displayed (see also *Appendix A, Error Codes*).

Returning Instruments for Service/Repair

If you need to return an instrument to BioTek for service or repair, please contact the TAC for a Return Materials Authorization (RMA) number *before* shipping the instrument. Repackage the instrument properly (see *Chapter 2, Installation*), write the RMA number on the shipping box, and ship to this address:

BioTek Instruments, Inc.
Technical Assistance Center
100 Tigan Street
Highland Park
Winooski, Vermont 05404 USA

Chapter 2

Installation

This chapter includes instructions for unpacking and setting up the ELx50™ Microplate Strip Washer, installing the washer's components, and repackaging the instrument for shipment.

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Unpacking and Inspecting the Instrument



Important! Save all packaging materials. If the washer is shipped to the factory for repair or replacement, it must be carefully repackaged, according to the instructions on pp. 38 to 49, using the original packing materials. Using other forms of commercially available packing materials, or failure to follow the repackaging instructions may **void your warranty**. If the original packing materials have been damaged, contact BioTek and ask for part number **4073001**.

The ELx50™ washer and its accessories are securely packaged inside custom-designed shipping materials. This packaging should protect the instrument from damage during shipping. Inspect the shipping box, packaging, instrument, and accessories for signs of damage.

If the washer is damaged: Notify the carrier and your manufacturer's representative. Keep the shipping cartons and packing material for the carrier's inspection. The manufacturer will arrange for repair or replacement of your instrument immediately, before the shipping-related claim is settled.

Refer to the unpacking instructions and **Figures 2 through 6** on the following pages when removing the instrument and its accessories from the shipping container.

See **Repackaging and Shipping** at the end of this chapter for complete shipping instructions.

Unpacking the 16-Channel Manifold, Mist Shield, and Bottles

1. Carefully open the outer shipping container and lift the top packing container and shipping tray that contain the accessories out of the container.
2. Remove the 16-channel manifold, mist shield, and waste and supply bottles, and then set aside their shipping materials.
3. Refer to **Figure 3** on the following page for unpacking the shipping tray for the 8-, 8s-, or 12-channel manifold, microplate carrier, power supply, tubing, in-line filter, and other accessories.

❖ The bottles include two 2-liter supply bottles and one 2-liter waste bottle. The "V" version of the ELx50™ (washers equipped with the optional valve module) will include three 2-liter supply bottles.

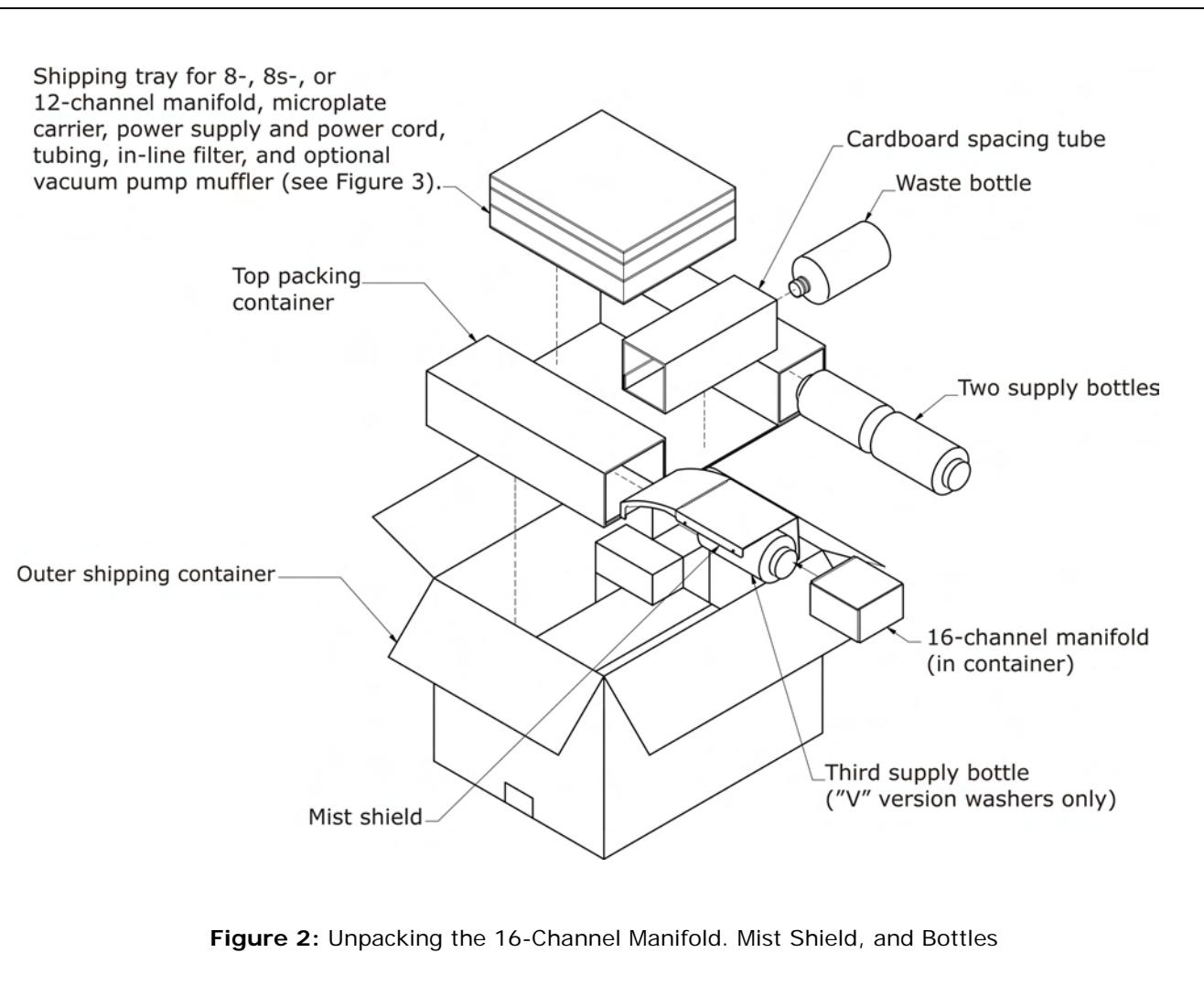


Figure 2: Unpacking the 16-Channel Manifold, Mist Shield, and Bottles

Unpacking the 8-, 8s-, or 12-Channel Manifold, Microplate Carrier, Power Supply, Tubing, In-Line Filter, and Optional Pump Muffler

1. Carefully open the shipping tray for the 8-, 8s-, or 12-channel manifold, microplate carrier, power supply and power cord, tubing, in-line vacuum filter, optional vacuum pump muffler, manual, and Declaration of Conformity or other documents.
2. Remove the accessories listed above and set aside the shipping materials.

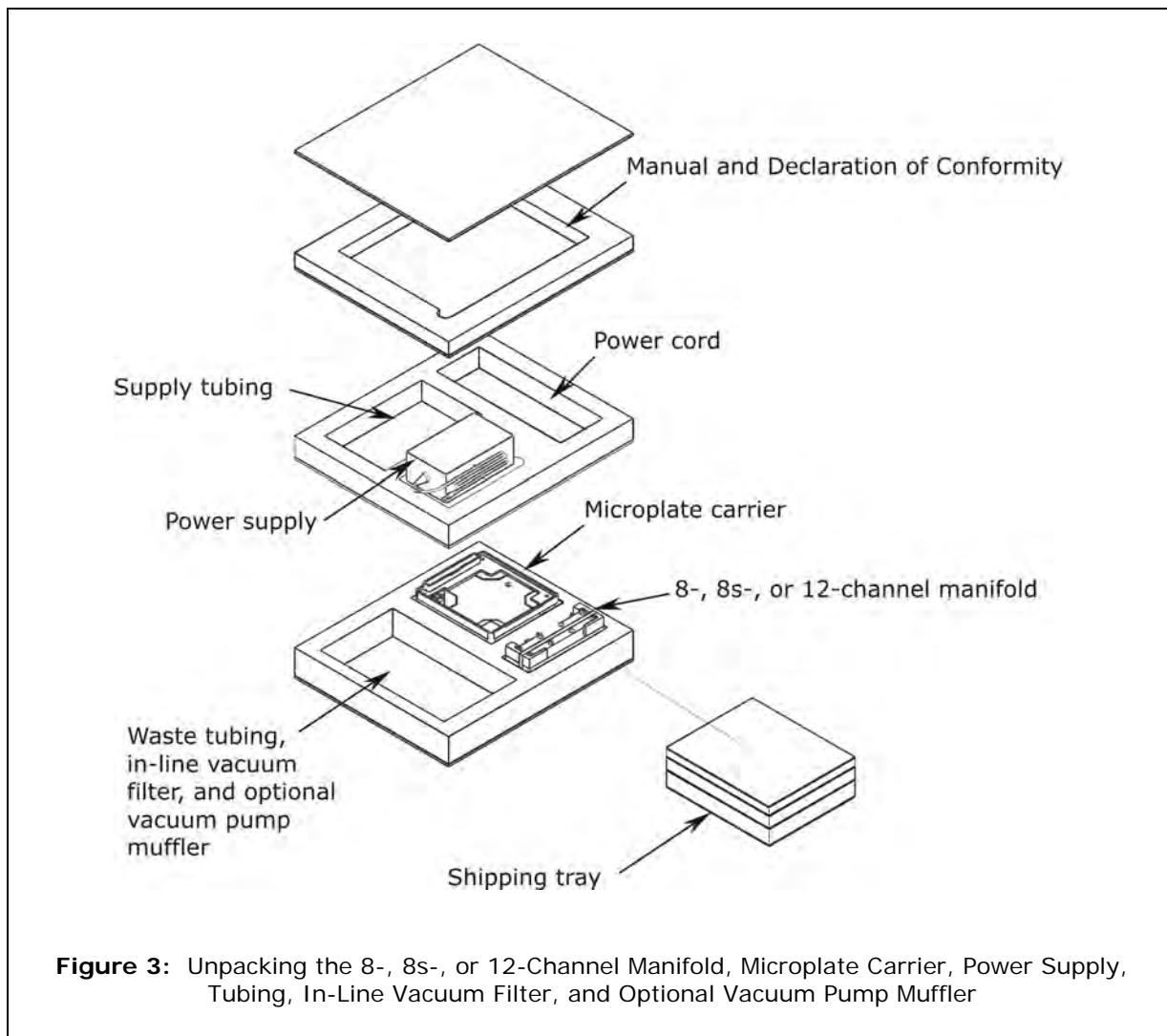


Figure 3: Unpacking the 8-, 8s-, or 12-Channel Manifold, Microplate Carrier, Power Supply, Tubing, In-Line Vacuum Filter, and Optional Vacuum Pump Muffler

Unpacking the Inner Shipping Container and Foam Corner Blocks

1. Lift the inner shipping container with the eight foam corner blocks out of the outer shipping container as shown in the figure below and place it upon a level surface. This package contains the washer. **ELx50™/8FMW washers** include an aspiration carrier and two vent plugs.
2. Remove and set aside the foam corner blocks.
3. Carefully open the inner shipping container, using a blunt tool.

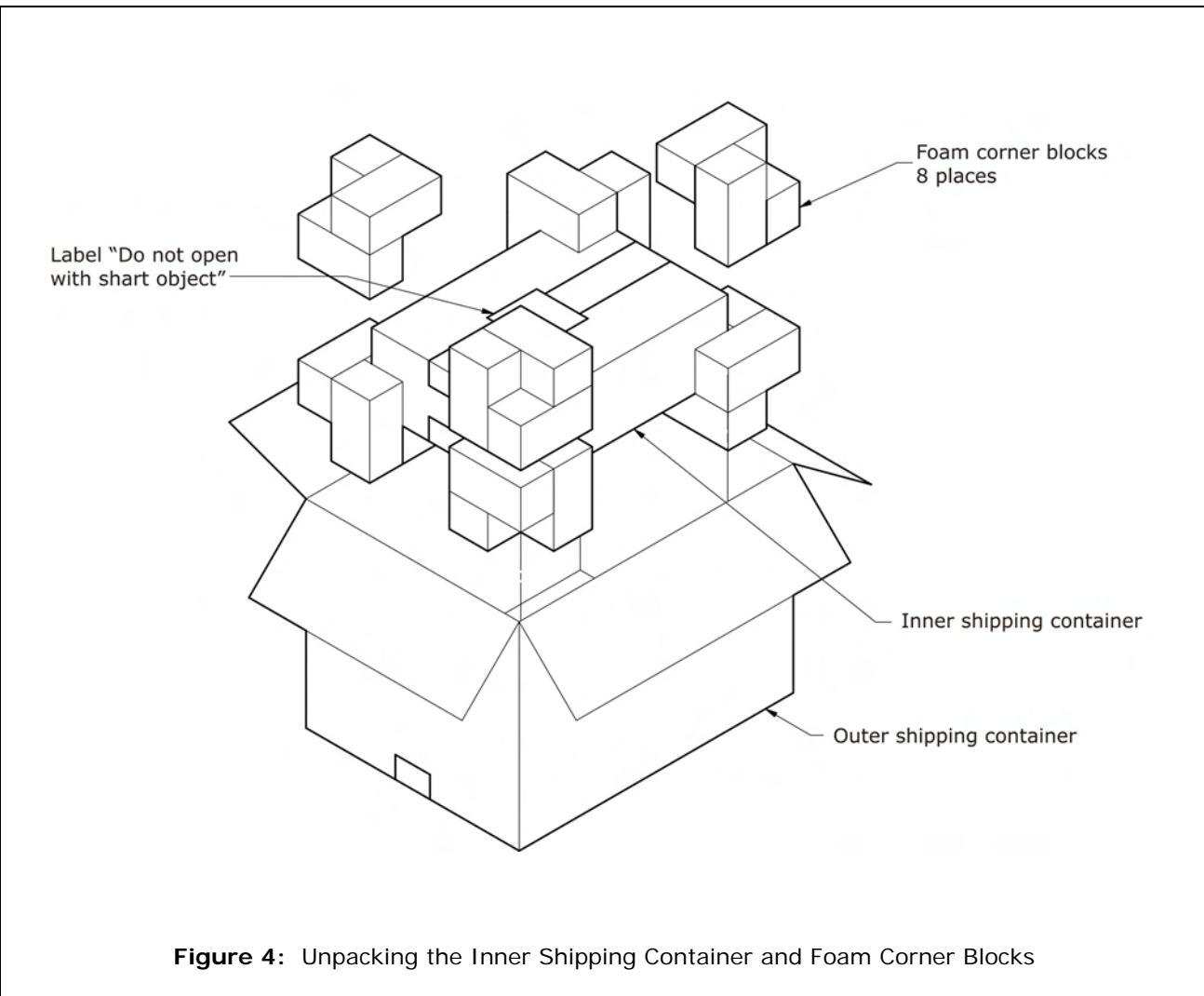


Figure 4: Unpacking the Inner Shipping Container and Foam Corner Blocks

Unpacking the Aspiration Carrier (ELx50/8FMW models only)

1. Remove the aspiration carrier from its storage compartment in the inner shipping container.
2. Remove and set aside any bubble wrap, plastic bag, or other shipping materials.

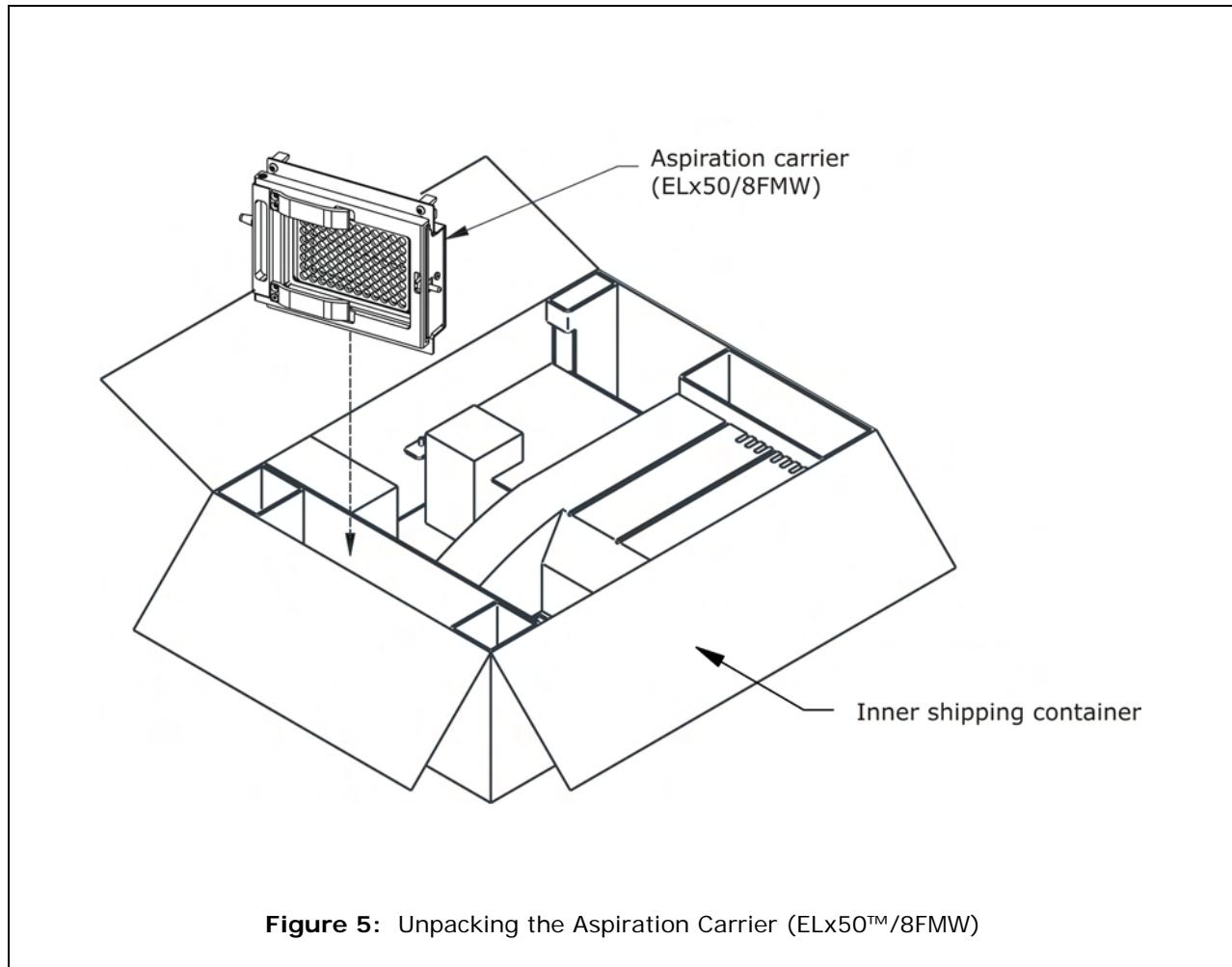


Figure 5: Unpacking the Aspiration Carrier (ELx50™/8FMW)

Unpacking the ELx50™ Washer

1. Lift insert #2, then insert #1 out of the inner shipping container (as shown below).
2. Carefully lift the washer out of the inner shipping container and place it on a level surface.
3. Remove the washer from the plastic bag.
4. Slide the foam shipping block out from underneath the manifold mounting bracket.
5. Store the inner shipping container and all shipping materials (including those noted on the previous pages) in the outer shipping container.

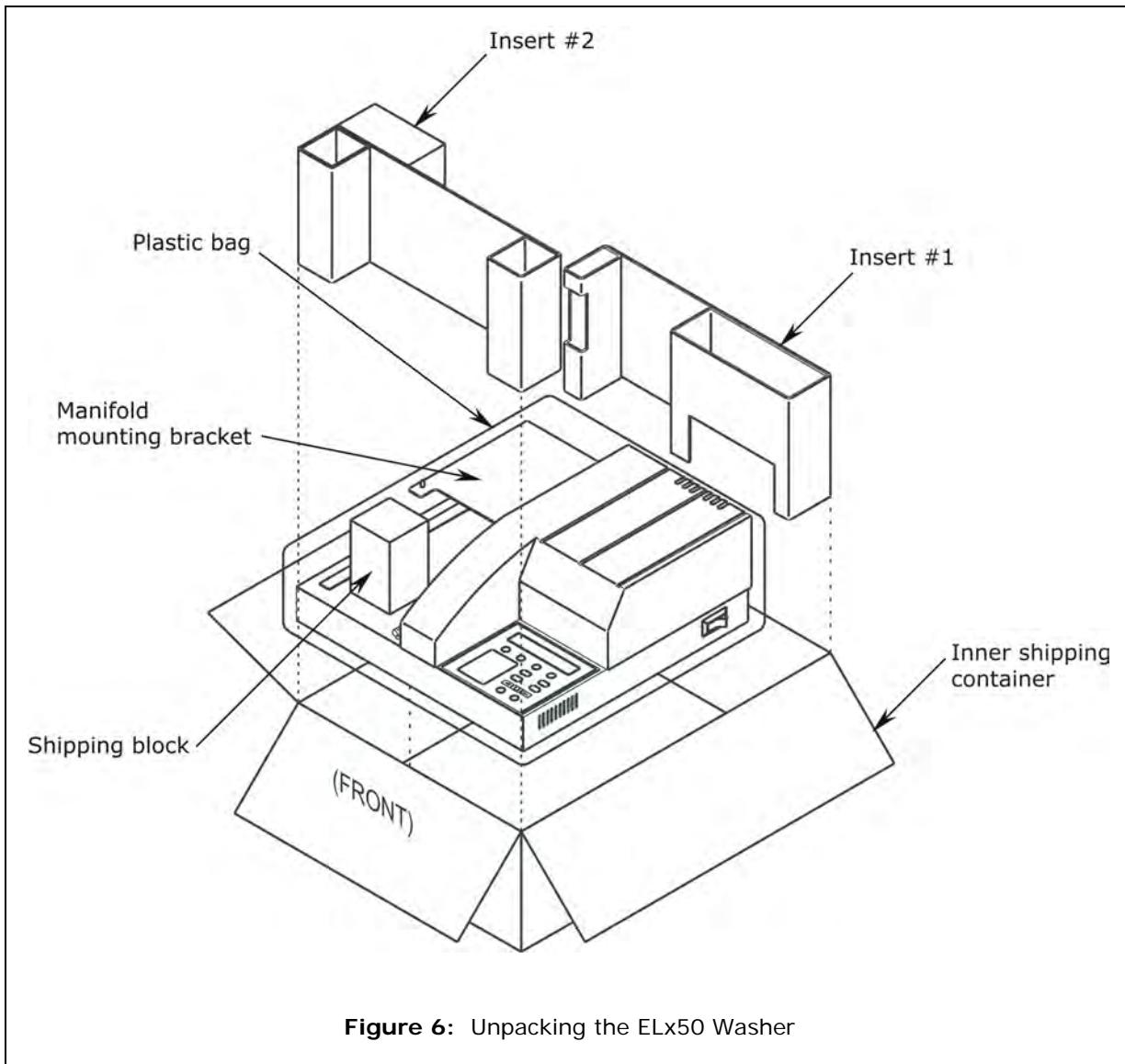


Figure 6: Unpacking the ELx50 Washer

Setting Up the ELx50



Important! Avoid **excessive humidity**. Condensation directly on the sensitive electronic circuits can cause the instrument to fail internal self checks.

The manifold dispense tubes have a protective Teflon collar at the tip. This is to prevent dripping. **Do not remove these coverings!**

Operating Environment

The ELx50™ washer is sensitive to extreme environmental conditions. For optimal operation, install the washer

- on a level surface,
- in an area where ambient temperatures between 15°C (59°F) and 40°C (104°F) can be maintained, and
- away from excess humidity.

See **Specifications** in **Chapter 1, Introduction**, for a list of environmental specifications.

Installing the Carrier and Manifold

All ELx50 washers have a microplate carrier that is specific to their manifold type. See **ELx50 Washer Variations** in **Chapter 1, Introduction**, for information on the various manifold and carrier types.

Refer to **Figures 7** and **8** when installing the microplate carrier and manifold.

ELx50/8FMW: Refer to **Figures 9** and **10** when installing the aspiration carrier.

Microplate Carrier

1. Hold the microplate carrier over the rail so that the priming/soaking trough is closest to the rear of the washer.
2. Line up the pin on the underside of the carrier with the slot on the carrier transport.
3. Snap the two carrier rail guides onto the carrier transport rail. The pin should sit in the slot.

8-, 8s-, or 12-Channel Manifold

1. Orient the manifold so that the aspirate/dispense tubes are pointed down, and the fittings for the supply and waste tubing are pointed toward the back of the washer.
2. Slide the manifold gently down over the two support pins on the manifold mounting bracket that are closest to the front of the washer.
3. Insert the thumbscrews (2). Do not overtighten.

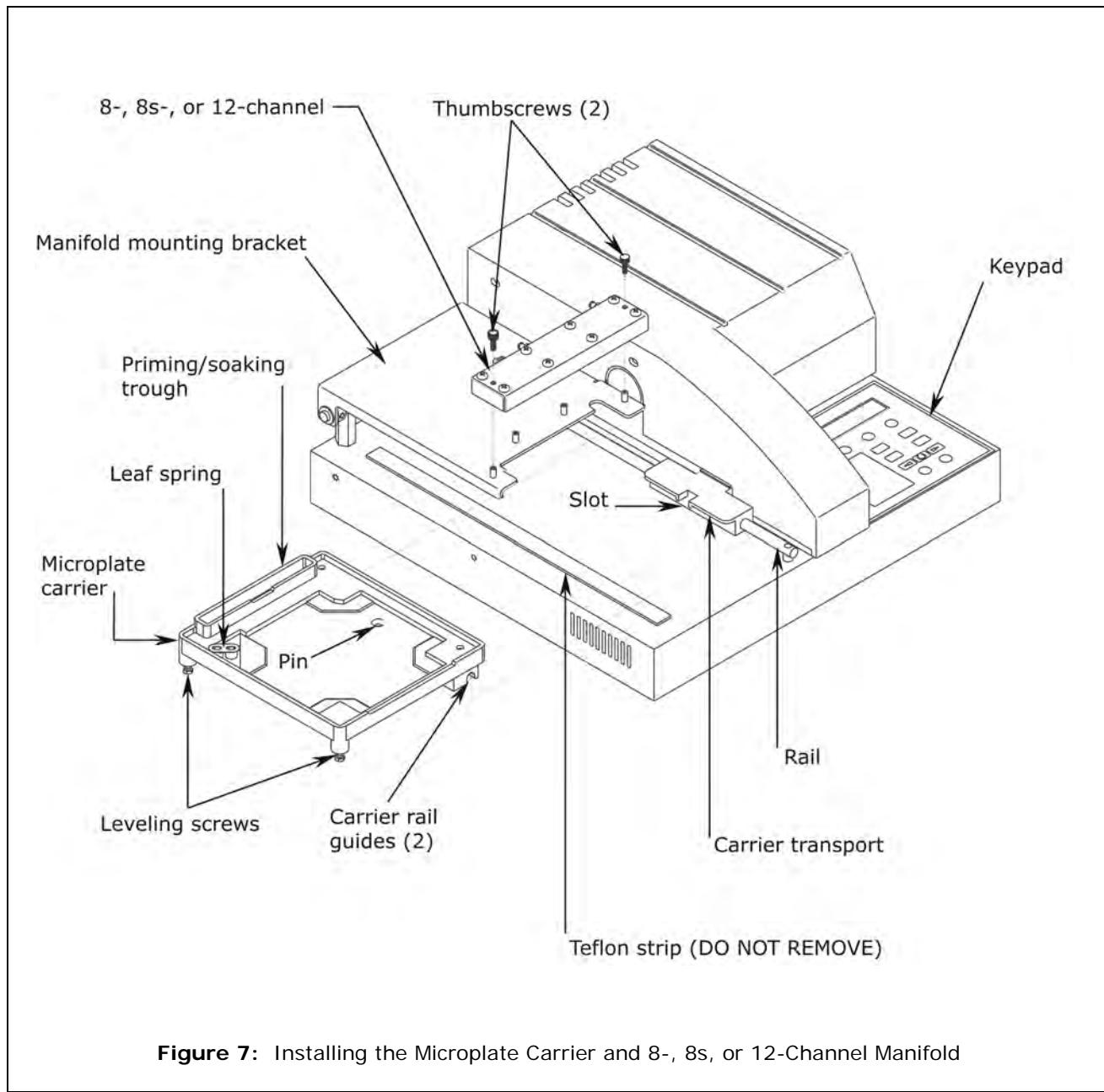


Figure 7: Installing the Microplate Carrier and 8-, 8s, or 12-Channel Manifold

16-Channel Manifold

1. Orient the manifold so that the aspirate/dispense tubes are pointed down, and the fittings for the supply and waste tubing are pointed toward the back of the washer.
2. Slide the manifold gently down over the three support pins on the manifold mounting bracket.
3. Insert the thumbscrews (3). Do not overtighten.

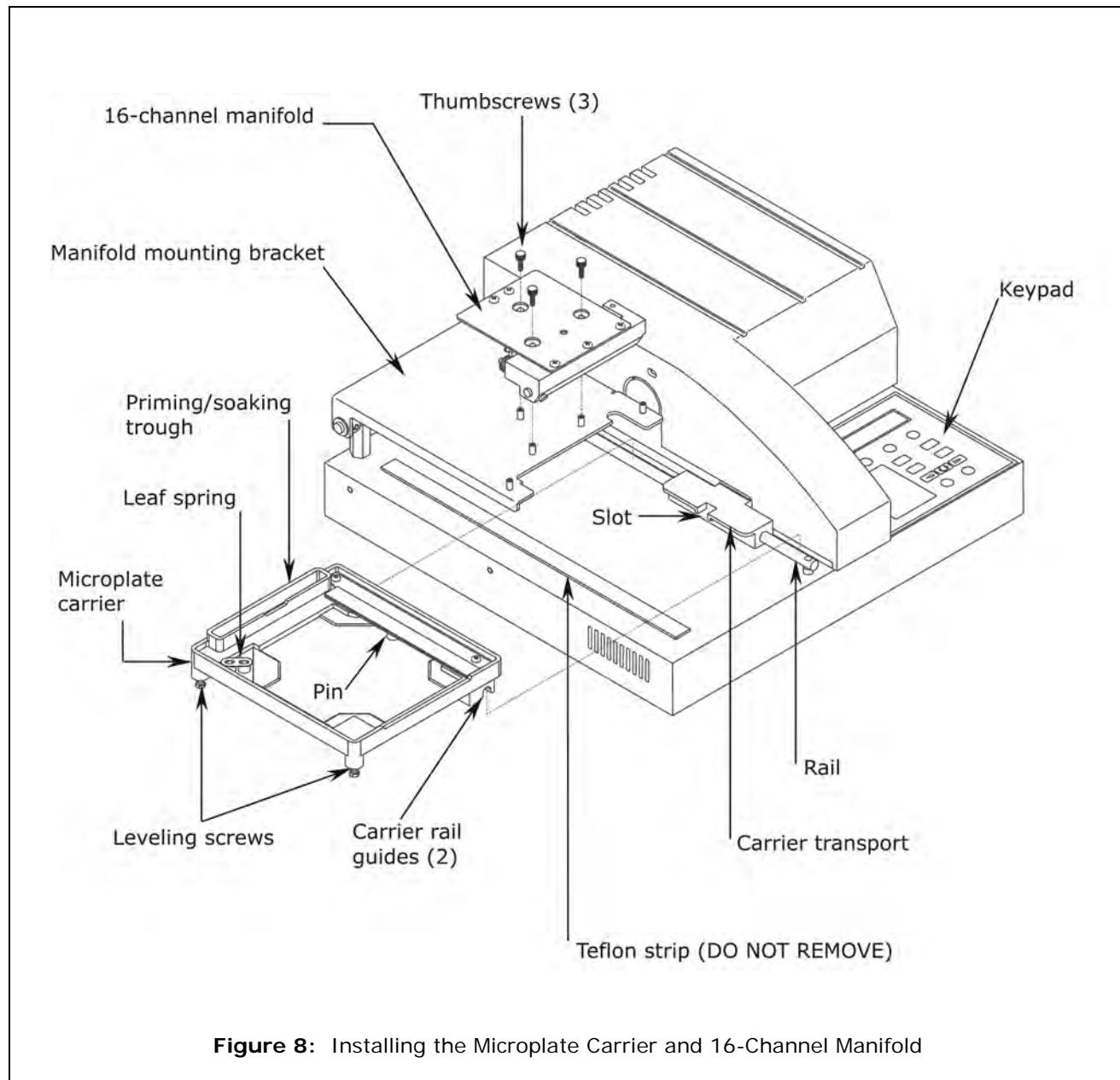


Figure 8: Installing the Microplate Carrier and 16-Channel Manifold

Aspiration Carrier (ELx50™/8FMW)

- ❖ For **bottom aspiration** using the aspiration carrier, the 8- or 8s-channel manifold must be installed. The aspiration carrier does not support the 12-channel manifold.

1. Hold the aspiration carrier over the rail so that the priming/soaking trough is closest to the rear of the washer.
2. Line up the pin on the underside of the carrier with the slot on the carrier transport.
3. Snap the two carrier rail guides onto the carrier transport rail. The pin should sit in the slot.
4. Follow the instructions on the next page for setting the vacuum levels using the vent port and vent plugs.

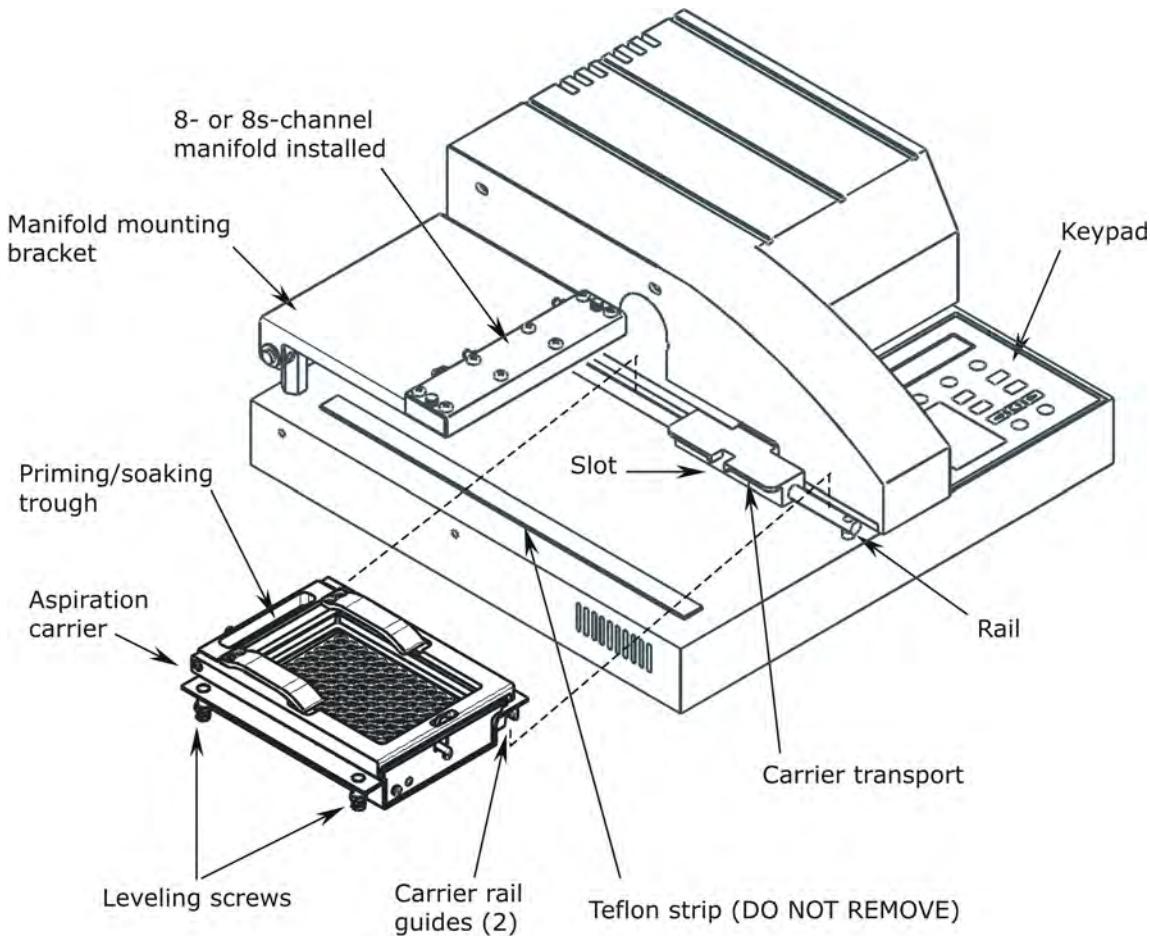


Figure 9: Installing the Aspiration Carrier (ELx50/8FMW model)

5. Slide the latch on the plate clamp to the right to open the clamp, whenever inserting or removing a plate.
6. Use the vent port (labeled "C") on the carrier and the two vent plugs (located in storage slots "A" and "B") to vary the vacuum levels. The vent port is a 0.047" diameter hole, which is equal to approximately -64 mmHg. The gray vent plug contains a 0.032" diameter hole, which is equal to approximately -116 mmHg. The black vent plug contains a 0.020" diameter hole, which is equal to approximately -240 mmHg.
 - For a **low** vacuum level, leave the vent port on the carrier **open**.
 - For a **medium** vacuum level, insert the **gray** vent plug into the vent port.
 - For a **high** vacuum level, insert the **black** vent plug into the vent port.

❖ The approximate vacuum levels listed above (-64, -116, and -240 mmHg) are "typical" only, and may vary, depending upon factors such as relative humidity, barometric pressure, and mechanical tolerances.

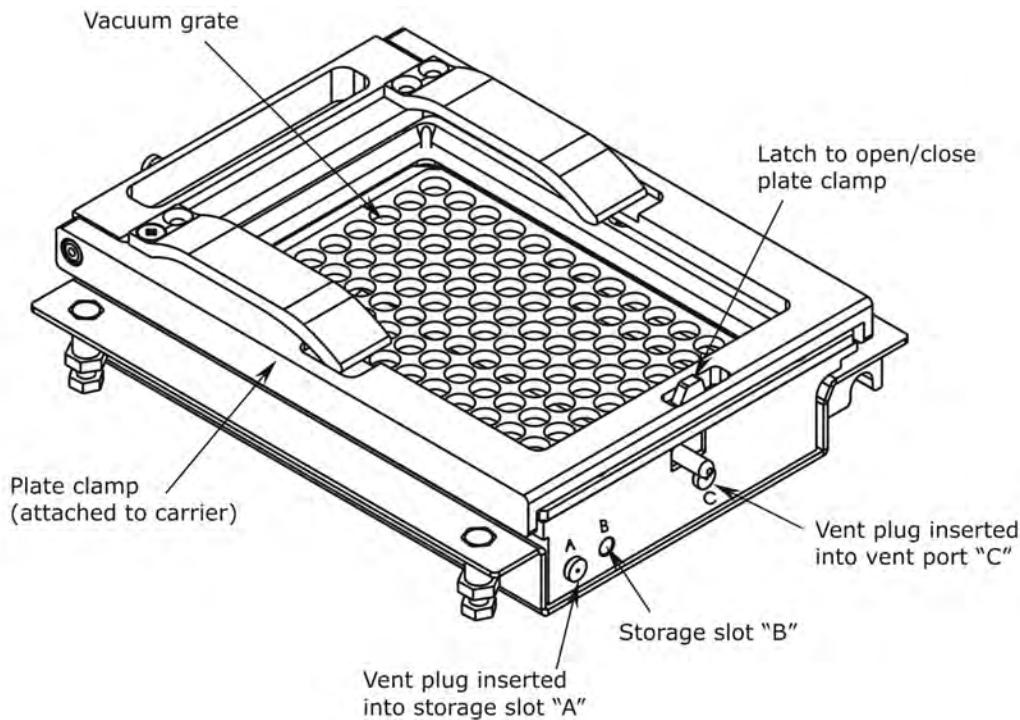
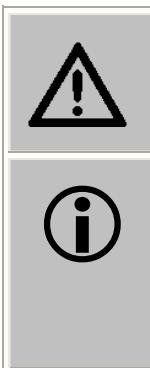


Figure 10: Close-Up View of Aspiration Carrier Vent Port and Vent Plugs

Connecting the Tubes and Bottles



Caution. The washer manifold, the vacuum port, and the supply bottles have Luer fittings. **Finger-tighten only!!**

Important! Review *Figures 11* through *17* on the following pages, as well as the diagram on the back of the washer. Identify the different tubes and bottles that came with your washer.

For optimal operation of the ELx50™ washer, all tubing, cables, and fittings for the waste and supply systems must be properly connected. The figures on the following pages illustrate the rear panel of the instrument and the locations of the ports and connections for the waste and supply systems.

Liquid Level Alert™ option: If you purchased the Liquid Level Alert option, its components are shipped in a separate box. Install the waste and supply bottle(s) as described on the following pages, and then install the select box and connect the cables as described on page 34.

- For PN 4070035 (non-“V” version washers), components include a select box, one 2-liter supply bottle, and one 2-liter waste bottle.
- For PN 4070036 (“V” version washers), components include a select box, three 2-liter supply bottles, and one 2-liter waste bottle.

Vacuum Pump Muffler: An optional vacuum pump muffler (PN 4073009) is provided with ELx50 washers that are equipped with the new vacuum pump (washers manufactured after January 2008). If you wish to use the muffler, attach the female luer end of the muffler to the vacuum pump output/exhaust port on the rear panel of the washer. See *Figure 11b* and *Figure 12b* on the following pages for illustrations of the vacuum pump muffler.

Before Connecting the Tubes and Bottles

1. Rinse all bottles with deionized or distilled water before using. This rinsing eliminates particles that may have entered during packing or unpacking.
2. Place the supply and waste bottles on the same horizontal plane as the washer. This ensures optimum pump performance.

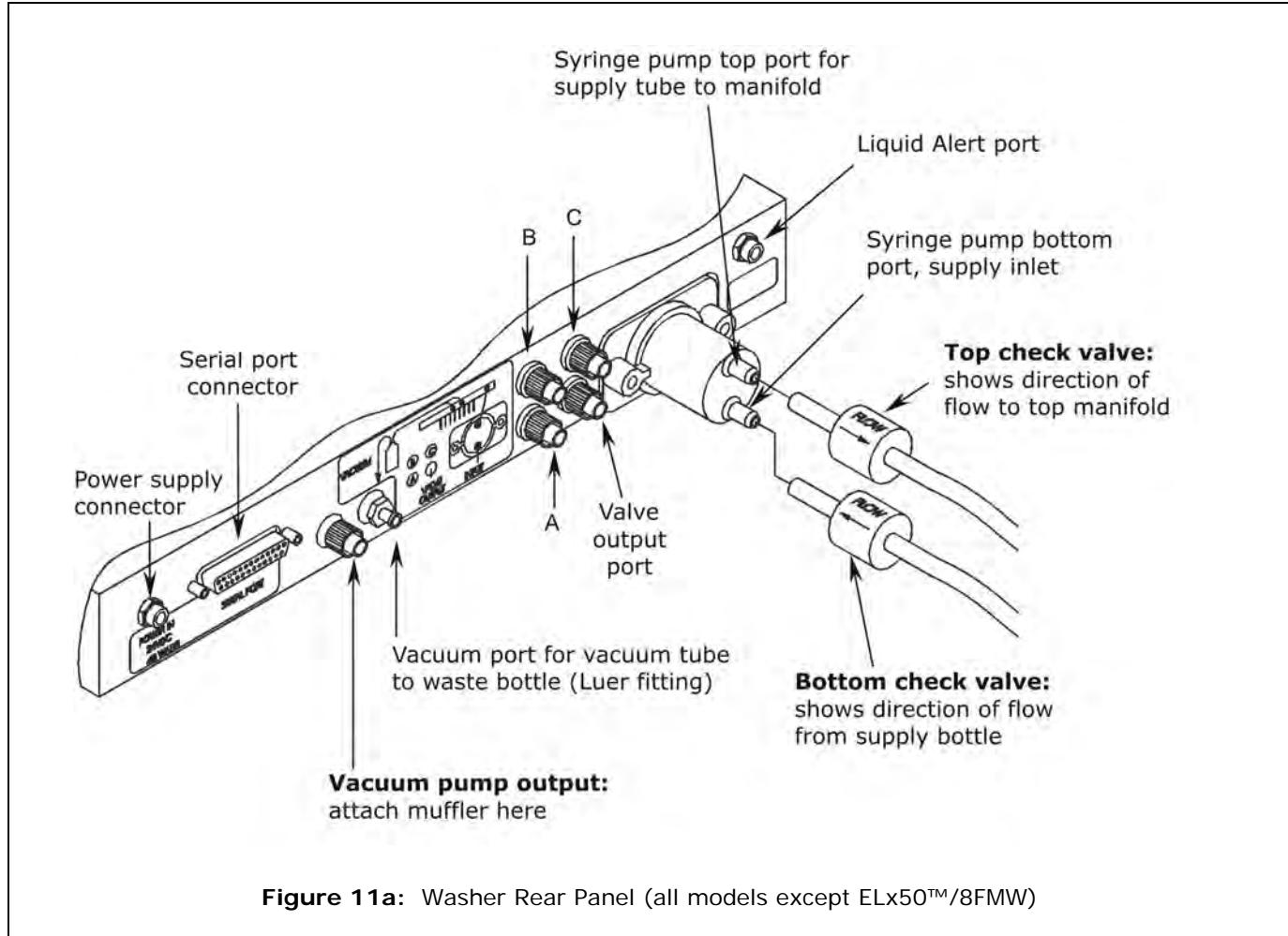


Figure 11a: Washer Rear Panel (all models except ELx50™/8FMW)

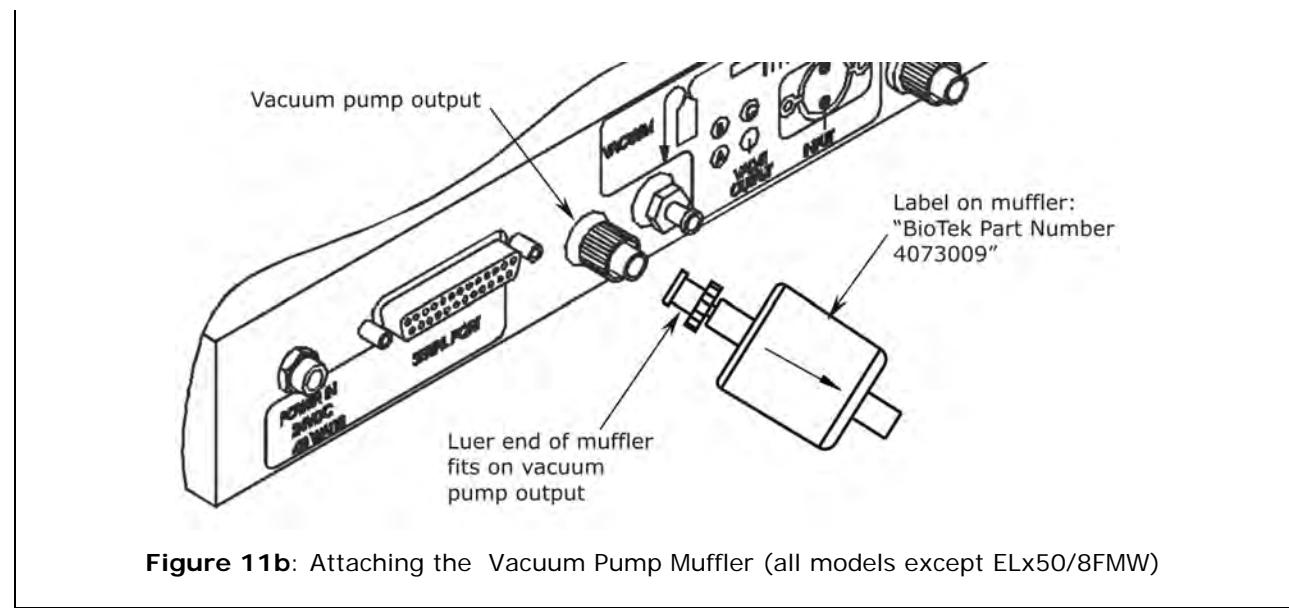


Figure 11b: Attaching the Vacuum Pump Muffler (all models except ELx50/8FMW)

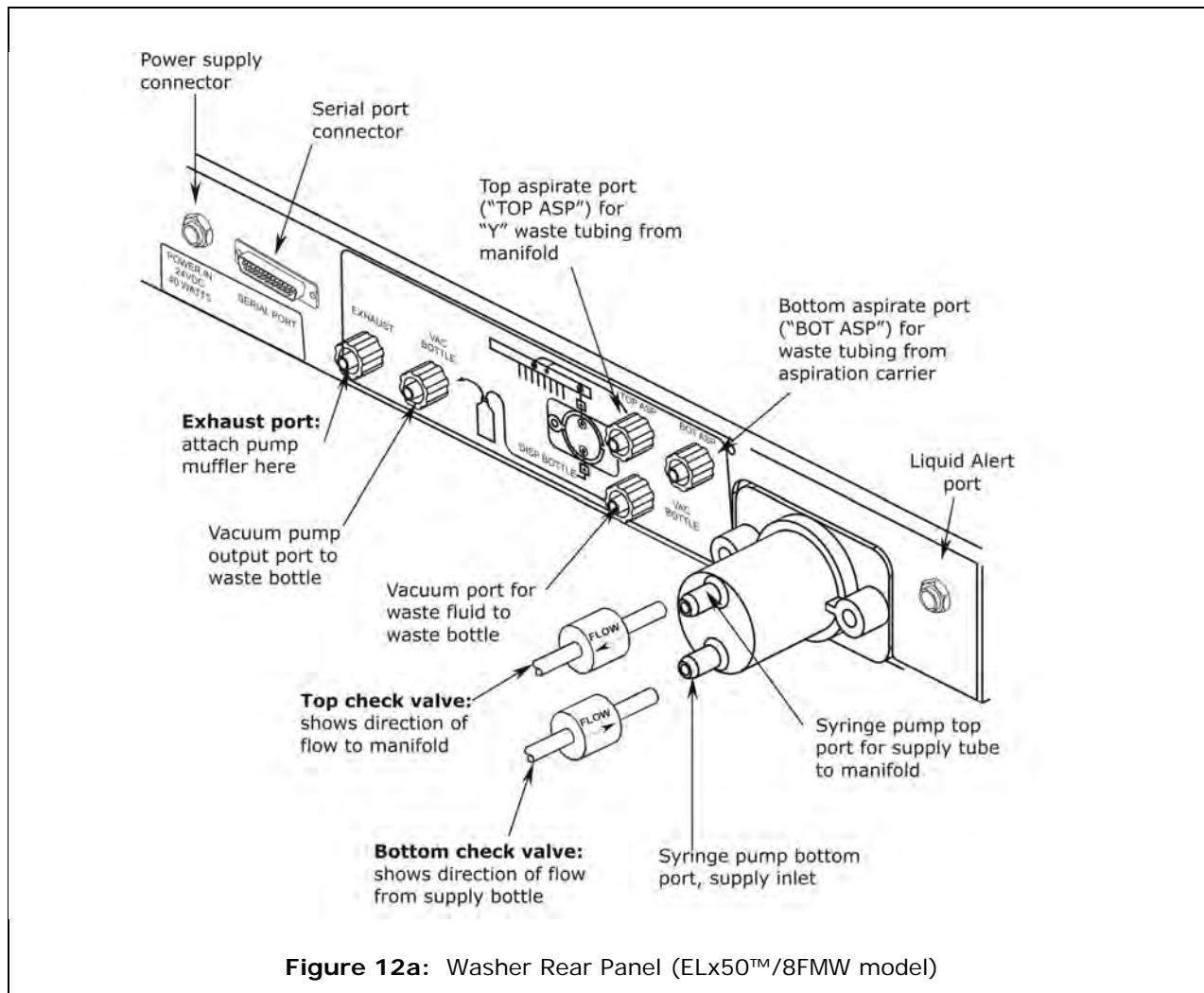


Figure 12a: Washer Rear Panel (ELx50™/8FMW model)

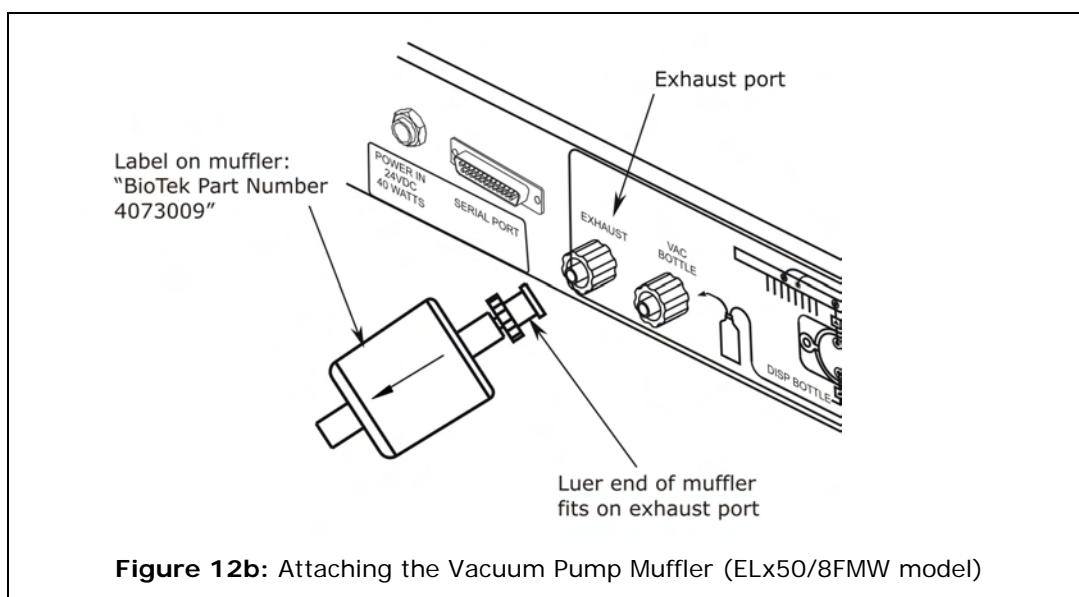


Figure 12b: Attaching the Vacuum Pump Muffler (ELx50/8FMW model)

Waste System

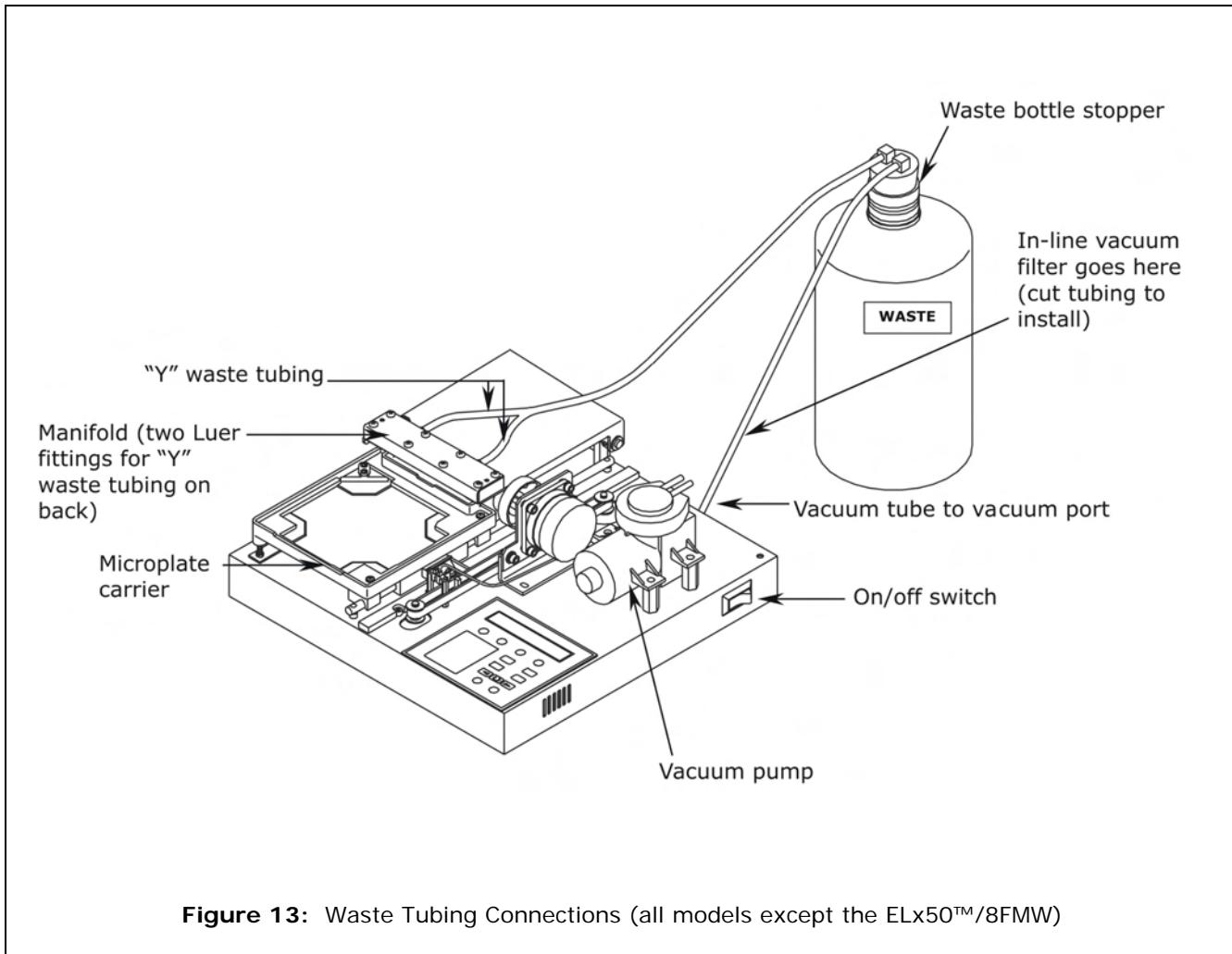
All models except the ELx50™/8FMW: Follow steps 1 through 4 below for connecting the waste tubing and bottle. Refer to **Figure 11** on page 26 for an illustration of the rear panel of the washer, and to **Figure 13** on page 29 for an illustration of the waste tubing connections.

1. Attach the paired (Y-shaped) waste tubing to the two waste ports on the back of the washer manifold. **Finger-tighten only!**
2. Remove the waste bottle cover and replace it with the stopper from the waste tubing set.
3. To install the optional* in-line vacuum filter, cut the tubing from the waste bottle to the vacuum pump output port in half and attach both cut ends to the vacuum filter ports.
4. Attach the free end of the tubing from the waste bottle to the vacuum port for waste fluid on the back of the washer. **Finger-tighten only!**

ELx50/8FMW model (with aspiration carrier installed): Follow steps 1 through 7 below for connecting the waste tubing and bottle. Refer to **Figure 12** on the previous page for an illustration of the rear panel of the washer, and to **Figure 14** on page 30 for an illustration of the waste tubing connections.

1. Attach the paired (Y-shaped) waste tubing to the two waste ports on the back of the washer manifold. **Finger-tighten only!**
2. Attach the free end of the waste tubing from the manifold to the top aspiration port ("TOP ASP") on the back of the washer.
Finger-tighten only!
3. Remove the waste bottle cover and replace it with the stopper from the waste tubing set.
4. Attach one tube from the waste bottle to the vacuum pump output port on the back of the washer.
5. To install the optional* in-line vacuum filter, cut the tubing from the waste bottle to the vacuum pump output port in half and attach both cut ends to the vacuum filter ports.
6. Attach the free end of the tubing from the waste bottle to the vacuum port for waste fluid on the back of the washer. **Finger-tighten only!**
7. Attach the waste tubing from the aspiration carrier to the bottom aspiration port ("BOT ASP") on the back of the washer. **Finger-tighten only!**

❖ The in-line vacuum filter is "optional" in the sense that the washer will function without it. It is strongly recommended that you install this filter, however, because (1) the filter prevents waste material aerosols from being released into the air, and (2) the filter serves as a *temporary* fluid barrier in the event that the waste bottle is allowed to overfill. (The replacement PN for the filter is 48146.)



❖ **Note:** The washer's top shroud is removed from this illustration for clarity only. While it is acceptable to remove the mist shield, **do not attempt to remove the shroud** protecting the washer's components.

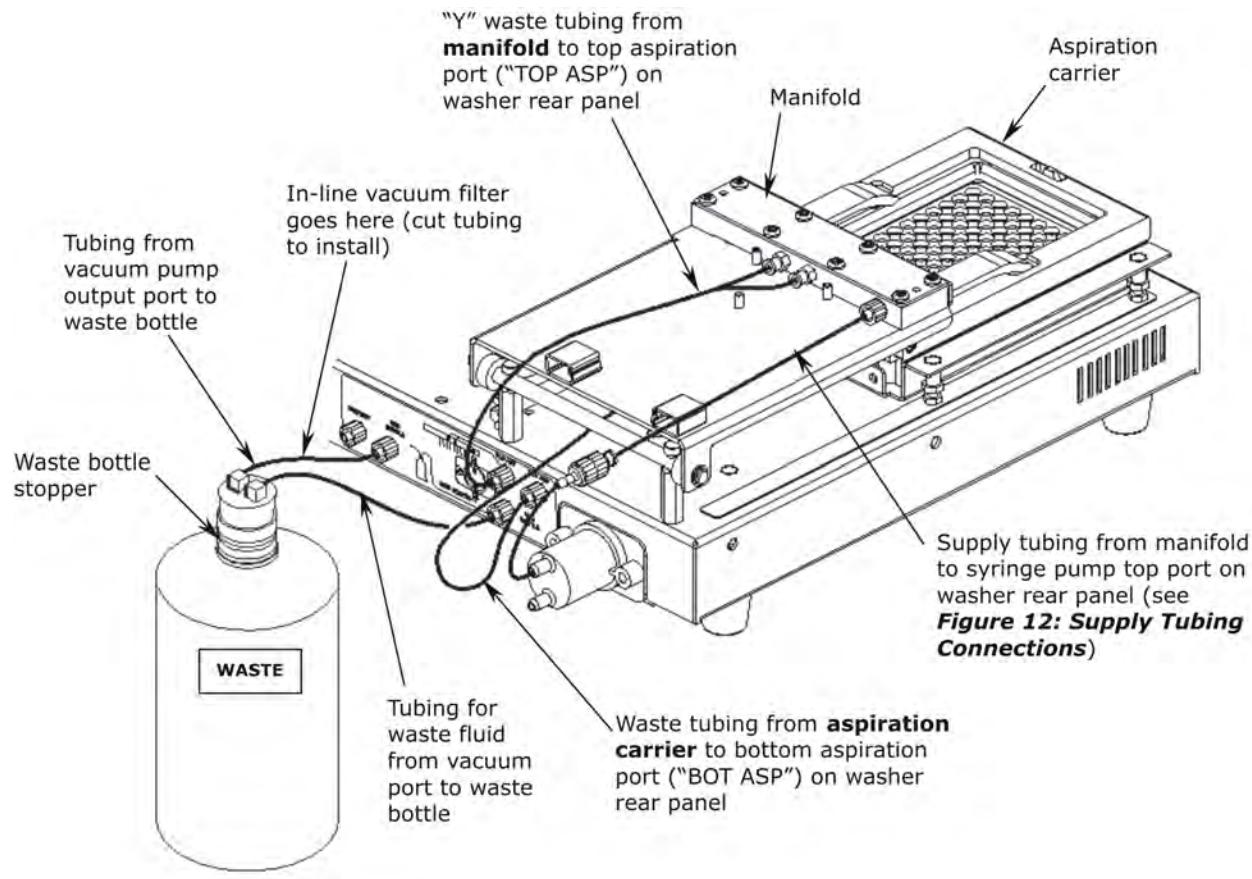


Figure 14: Waste Tubing Connections
(ELx50™/8FMW model with Aspiration Carrier installed)

Supply System

Refer to **Figure 15** for the following instructions.

1. Two check valves are supplied; note the flow direction arrows. Connect the check valves to the syringe pump top and bottom ports. Compare the flow direction arrows with those shown in **Figure 11** (all models except the ELx50™/8FMW) or **Figure 12** (ELx50/8FMW model).
2. Two supply tubes are provided, one short, one long. Connect one end of the short tube to the manifold. Connect the other end to the check valve that is connected to the syringe pump top port.
3. Washers **without** the multiple valve tubing option: Connect one end of the long tube to the supply bottle and the other end to the check valve connected to the syringe pump bottom port.
4. Washers **with** the multiple valve tubing option: The long tube is longer than necessary and should be cut to approximately 5 inches when installing to minimize prime volume. Connect one end of the 5-inch tube to the valve output port on the rear panel of the washer and the other end to the check valve connected to the syringe pump bottom port.

Attach the three tubes from supply bottles A, B, and C to valve ports A, B, and C on the back of the washer.

❖ **Note:** The ELx50/8FMW model does not support the multiple valve tubing option.

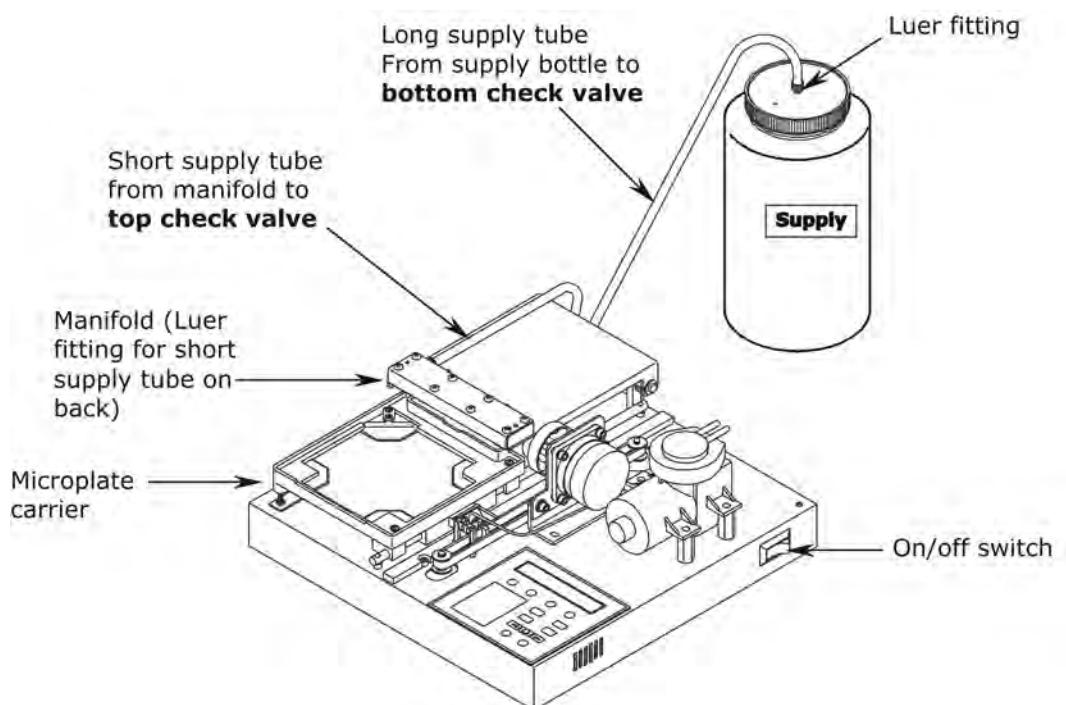


Figure 15a: Supply Tubing Connections (front view)

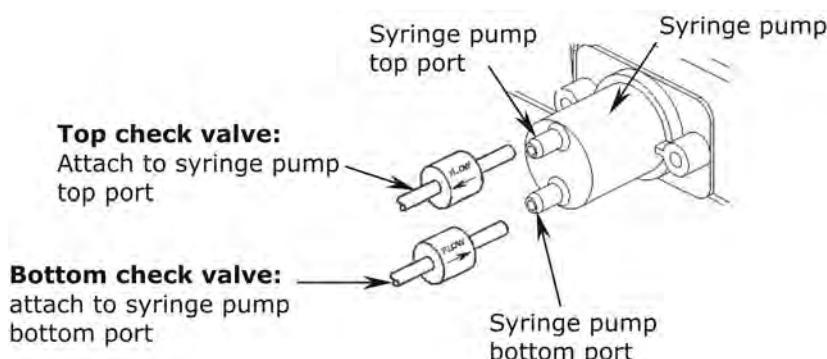
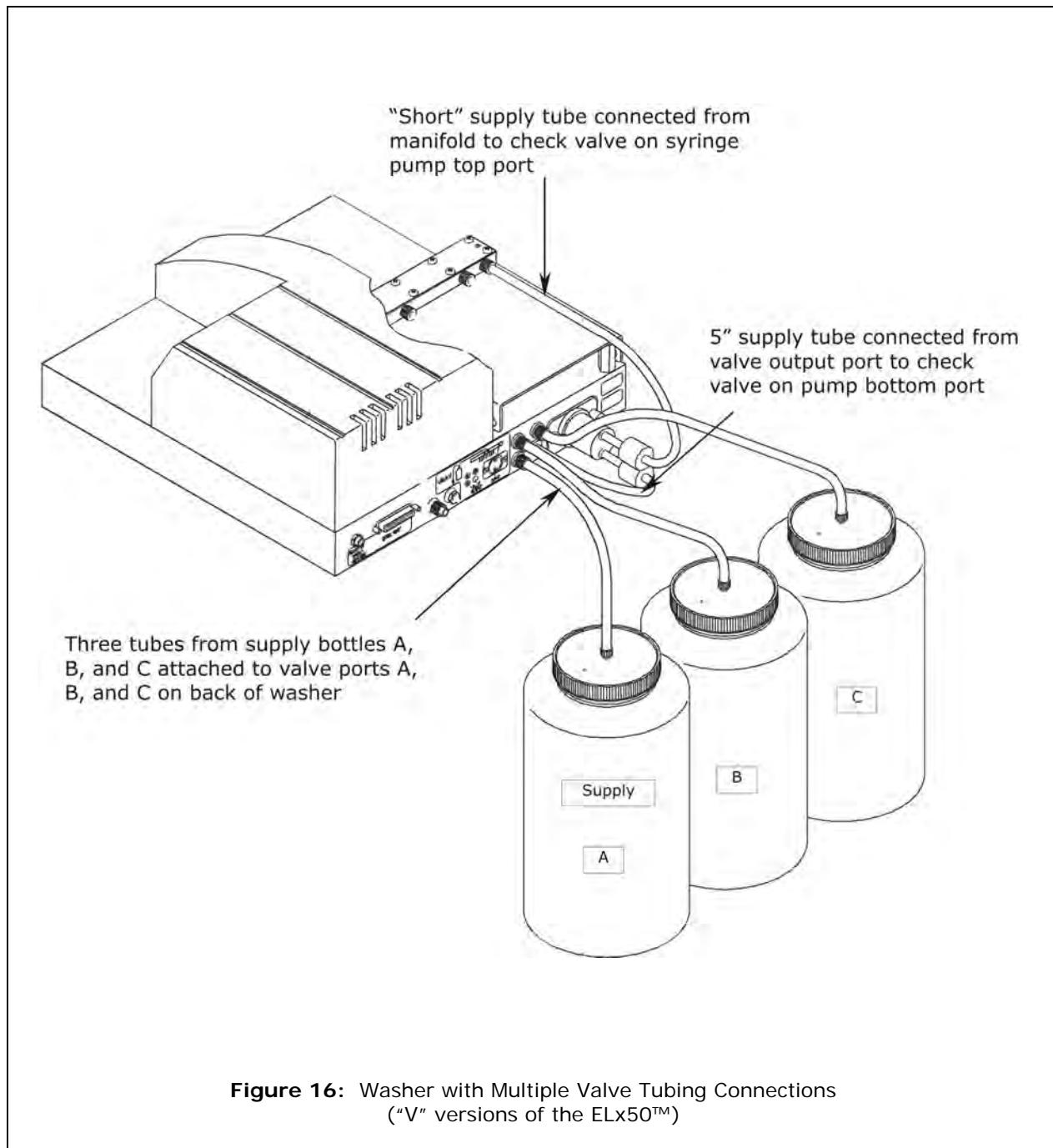


Figure 15b: Supply Tubing Connections (view of connections on rear panel)

❖ **Note:** The washer's top shroud is removed from this illustration for clarity only. While it is acceptable to remove the mist shield, **do not attempt to remove the shroud** protecting the washer's components.



Liquid Level Alert™ Option

If you have not already done so, connect the waste and supply bottles as described on the previous pages.

1. The Liquid Level Alert **select box** has four ports, labeled A, B, and C, for the supply bottle(s), and WASTE.
 - For washers with the Valve option, connect the supply bottle cables to the appropriate ports in the select box. If a port is left empty, insert one of the supplied “shorting plugs” (all ports must be filled).
 - For washers *without* the Valve option, connect the supply bottle cable to port A and then insert the supplied shorting plugs into ports B and C.
 - For all washers, connect the waste bottle cable to the WASTE port.
2. Connect the select box to the washer via the **LIQUID ALERT** port on the back of the washer.

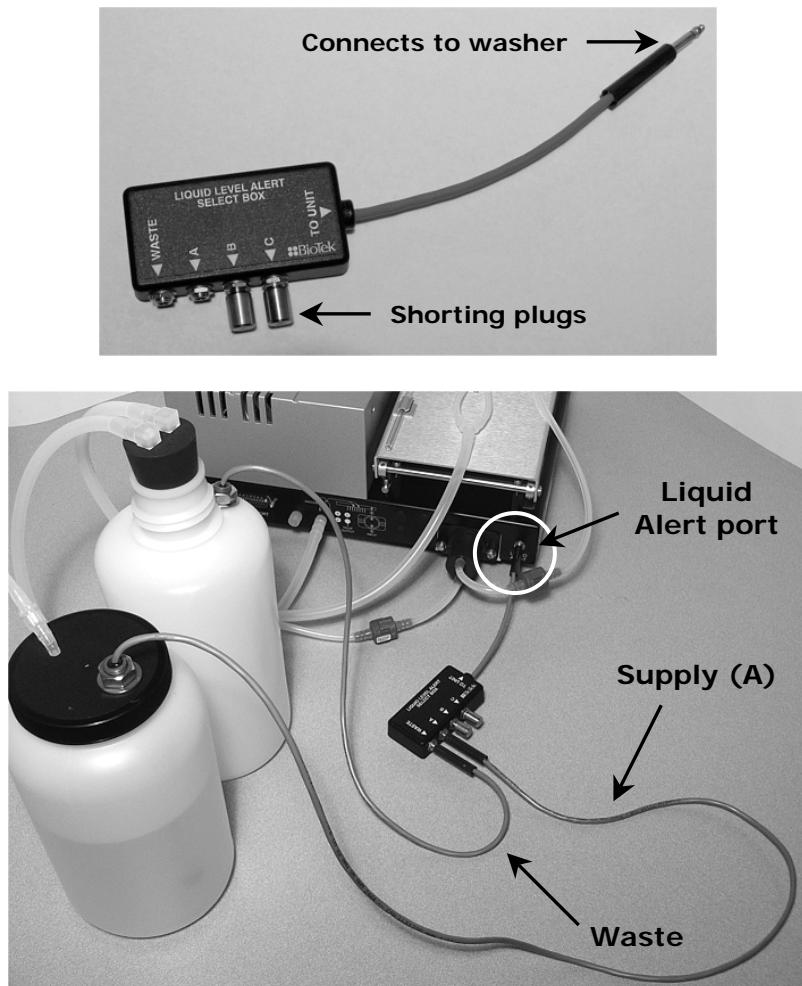


Figure 17: Liquid Level Alert select box (top), and cable connections

Final Check

1. Verify that the tubing was not crimped during installation.
2. Make sure that the fluid supply and the waste output tubes are attached to the appropriate manifold ports. If the mounted manifold tilts forward or backward, make sure that the tubing to the manifold is not being pulled tight or off to the side.

Attaching the Mist Shield

Refer to **Figure 18** below for the following instructions.

1. Insert the two thumbscrews into the slots on the washer's left side. Do not tighten completely.
2. Hold the mist shield parallel to the washer's left side, with the door toward the front of the washer. See below.
3. Slide the mist shield down so that the two slots fit over the thumbscrew shafts.
4. Insert the two pins into the slots on the washer's top left side.
5. Tighten the thumbscrews.

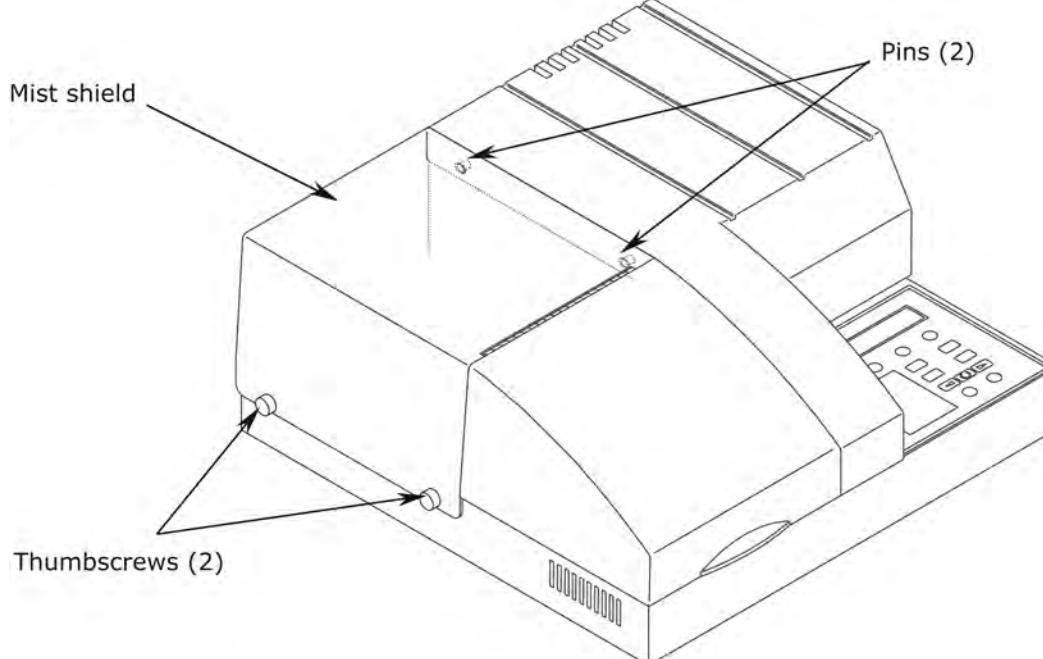


Figure 18: Attaching the Mist Shield

Connecting the Power Supply and Cord

	<p>Warning! Power Rating. The ELx50™ power supply must be connected to a power receptacle that provides voltage and current within the specified rating for the system. Use of an incompatible power receptacle may produce electrical shock and fire hazards.</p>
	<p>Warning! Electrical Grounding. Never use a two-prong plug adapter to connect primary power to the ELx50 power supply. Use of a two-prong adapter disconnects the utility ground, creating a severe shock hazard. Always connect the power cord directly to a three-prong receptacle with a functional ground.</p>

The ELx50™ Washer uses an external 24-volt power supply. The power supply automatically adjusts for input voltage in the range of 100 - 250 V~.

1. Plug the power supply's plug into the washer's rear panel. See **Figure 11** (all models except the ELx50/8FMW) or **Figure 12** (ELx50/8FMW model).
2. Insert the power cord into the power supply and into an appropriate wall outlet.

Serial Port for Communication With Other Devices

The ELx50 has a 25-pin serial (RS-232) port located on the rear panel of the instrument (see **Figure 11** or **Figure 12**). The serial port allows the washer to receive data from a computer for purposes of factory or dealer service.

Verifying Performance

Before using the ELx50™ washer for the first time, verify that it is operating properly by turning the washer on. The washer will automatically perform a system Self-Test to check the manifold, microplate carrier, vacuum pump and syringe pump positioning and operation. You can also choose to run this test from the washer's front panel, by selecting **UTIL > TESTS > SLFCHK**.

Once the self test has completed successfully, the washer is ready for use. For more information regarding verification of the washer's performance, see **Chapter 4, Maintenance and Performance Verification (IQ/OQ/PQ)**.

If the test passes, the Main Menu will be displayed. **If the test fails**, the washer will beep repeatedly and the display will show an error code. If this happens, note the error code and then press the **Stop** key on the keypad to stop the beeping. Refer to **Appendix A, Error Codes**, to determine its cause. If the problem is something you can fix, turn off the washer, fix the problem, and then turn the washer back on. If the cause is not something you can fix, contact BioTek's Technical Assistance Center.

Chapter 4, Maintenance and Performance Verification (IQ/OQ/PQ) provides recommended Installation and Operational Qualification procedures to be performed after the instrument is installed and set up as described in this chapter, and *before* the instrument is used in a laboratory environment.

The successful completion of the Installation Qualification confirms that the washer and its components have been supplied as ordered and ensures that they are assembled and configured properly for your lab environment. The successful completion of the Operational Qualification confirms that the washer is operating according to specification.

- ❖ **Note:** An **instrument qualification package** (PN 4070530) for the ELx50 is available for purchase from BioTek. The package contains thorough procedures for performing Installation Qualification, Operational Qualification and Performance Qualification (IQ/OQ/PQ) and preventive maintenance (PM). Extensive Checklists and Logbooks are included for recording results. Contact your local dealer for more information.



Important! Before operating this washer, review the **General Usage Guidelines** in **Chapter 3**. These guidelines include necessary steps to perform before running any program, information on performing periodic maintenance, and points to consider when creating or editing washer programs.

Rewrapping and Shipping

If you need to ship the ELx50™ Washer to BioTek for service or repair, be sure to use the original packing. Other forms of commercially available packing are not recommended and can void the warranty.

If the original packing materials have been damaged or lost, contact BioTek for replacement packing (see Technical Assistance in *Chapter 1* for contact information).

❖ The instrument's packaging design is subject to change over time. If the instructions in this section do not appear to apply to the packaging materials you are using, please contact BioTek's Technical Assistance Center for guidance.

Before Rewrapping the Instrument

	<p>Warning! If the washer has been exposed to potentially hazardous material, decontaminate it to minimize the risk to all who come in contact with the washer during shipping, handling and servicing.</p> <p>Decontamination prior to shipping is required by the U.S. Department of Transportation regulations.</p>
	<p>Important! Perform the following steps in the order presented before rewapping the washer for shipment.</p>

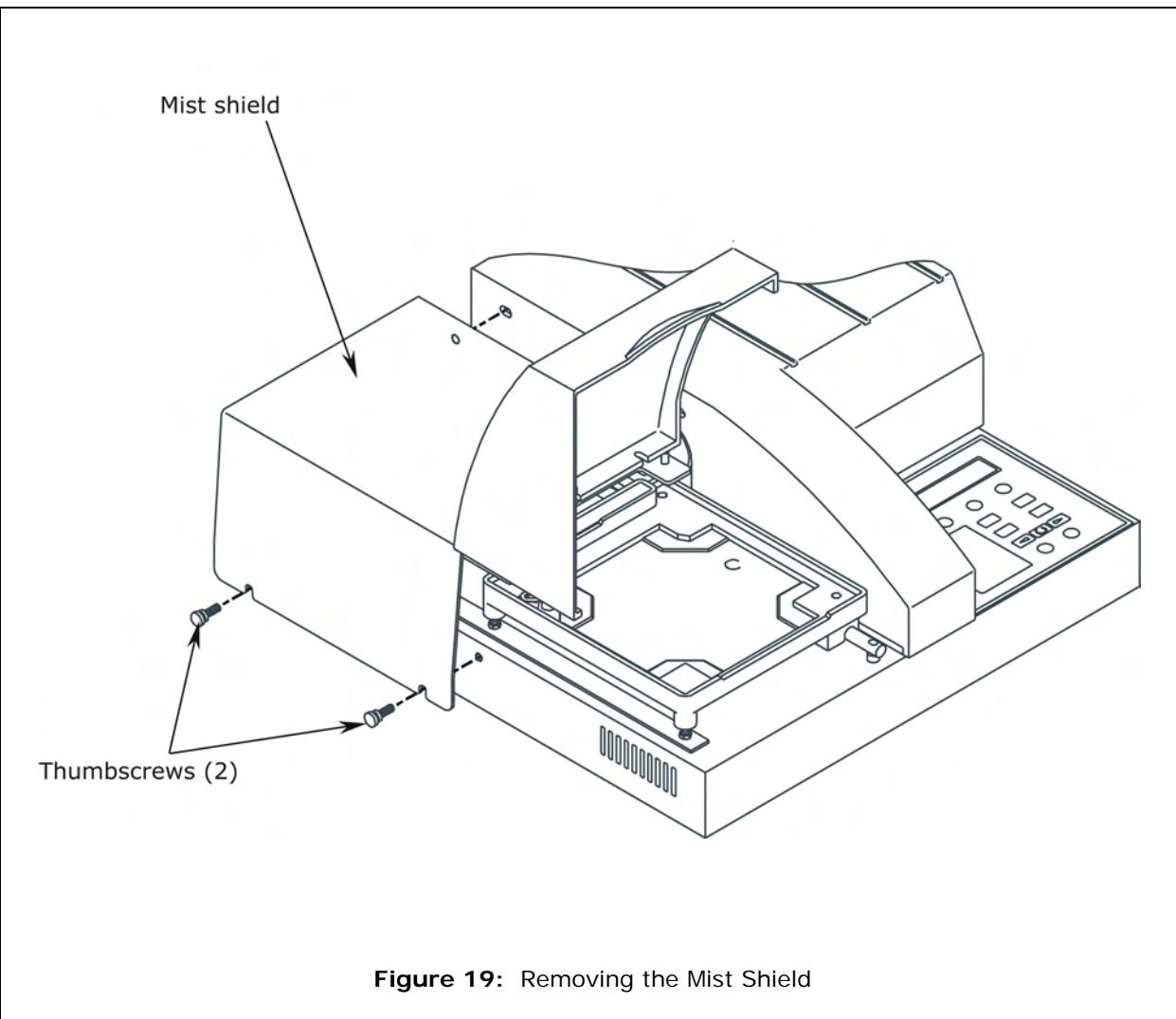
1. **Decontaminate** the washer and its accessories as necessary. Refer to the *Decontamination* procedure in *Chapter 4* for complete instructions.
2. Obtain a **Return Materials Authorization** (RMA) number from BioTek's Technical Assistance Center through BioTek's website, fax, or e-mail address listed in *Chapter 1*.
3. When obtaining the RMA, explain whether the washer requires calibration, cleaning, periodic maintenance, warranty work, and/or repair. Make a note of any error messages displayed and their frequency.
4. Provide BioTek with the name and contact information of a person who may be contacted if questions arise.
5. Mark the RMA number on the outside of the shipping box.
6. Insure the instrument for full value before shipping to BioTek.

Rewrap the ELx50 and Its Accessories

Refer to **Figures 19** through **29** below and on the following pages when repackaging the ELx50.

Removing the Mist Shield

1. Turn the washer off and disconnect the power supply cord and all waste and supply tubing (and, if applicable, the optional valve tubing) from the washer.
2. Remove the two mist shield thumbscrews.
3. Remove the mist shield and place it into a plastic bag (not shown).
4. Reinstall the two mist shield thumbscrews into their slots on the washer.



Removing the Manifold and Microplate Carrier

1. Remove the thumbscrews from the manifold.
2. **For all models of the manifold:** Lift the manifold carefully from the support pins on the manifold mounting bracket.
3. **For the 8-, 8s-, or 12-channel manifolds only:** Screw the two thumbscrews back into their support pins on the manifold mounting bracket.
4. Pack the manifold as instructed on the following two pages.
5. Remove the microplate carrier and place it into a plastic ziplock bag.

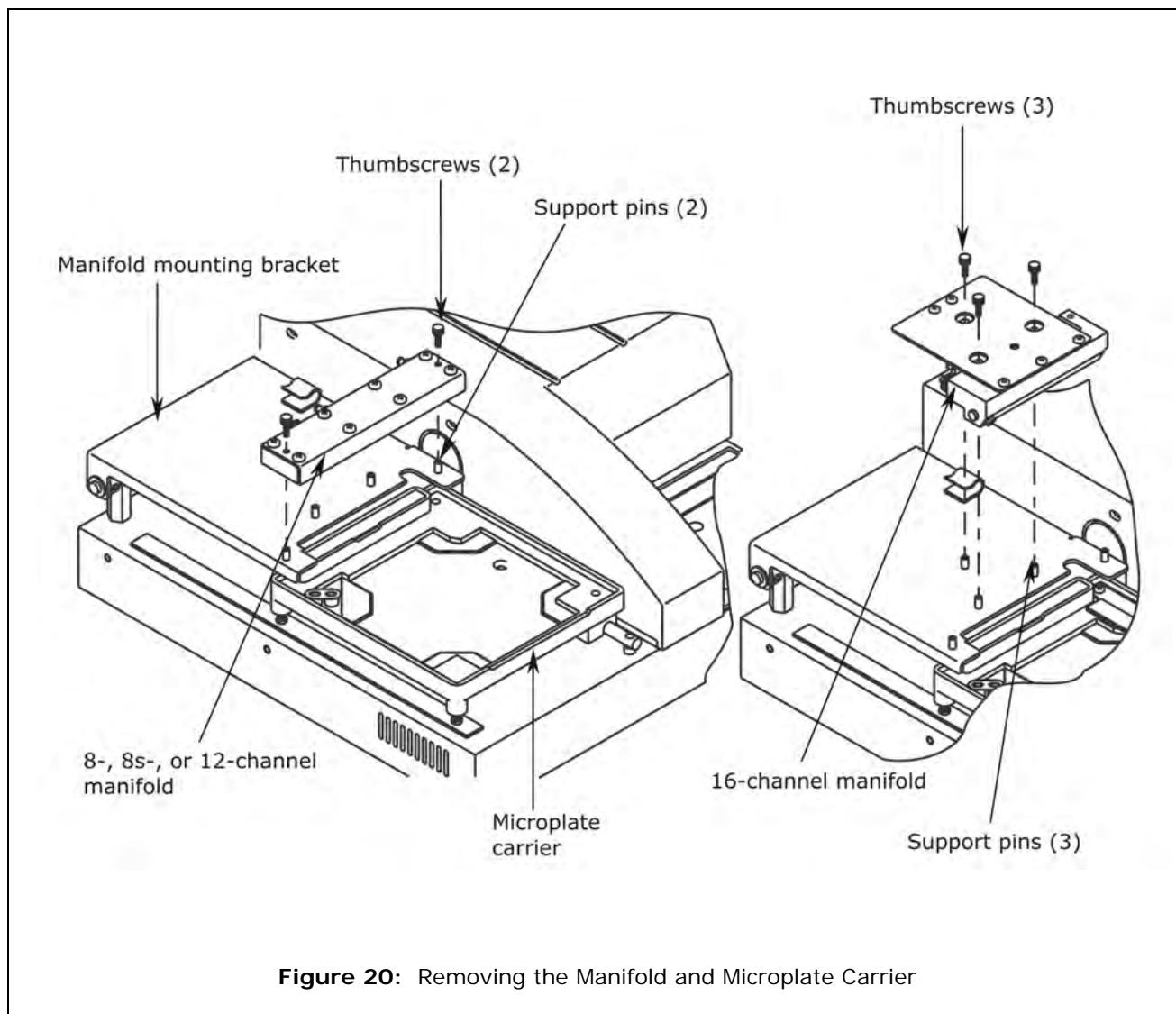


Figure 20: Removing the Manifold and Microplate Carrier

Removing the Aspiration Carrier (ELx50™/8FMW)

1. Disconnect the tubing from the back of the aspiration carrier.
2. Lift the carrier off the carrier transport rail.
3. Ensure that the two vent plugs are inserted in the "A" and "B" storage slots in the front panel of the carrier, for shipping.
4. Place the carrier into a plastic ziplock bag.

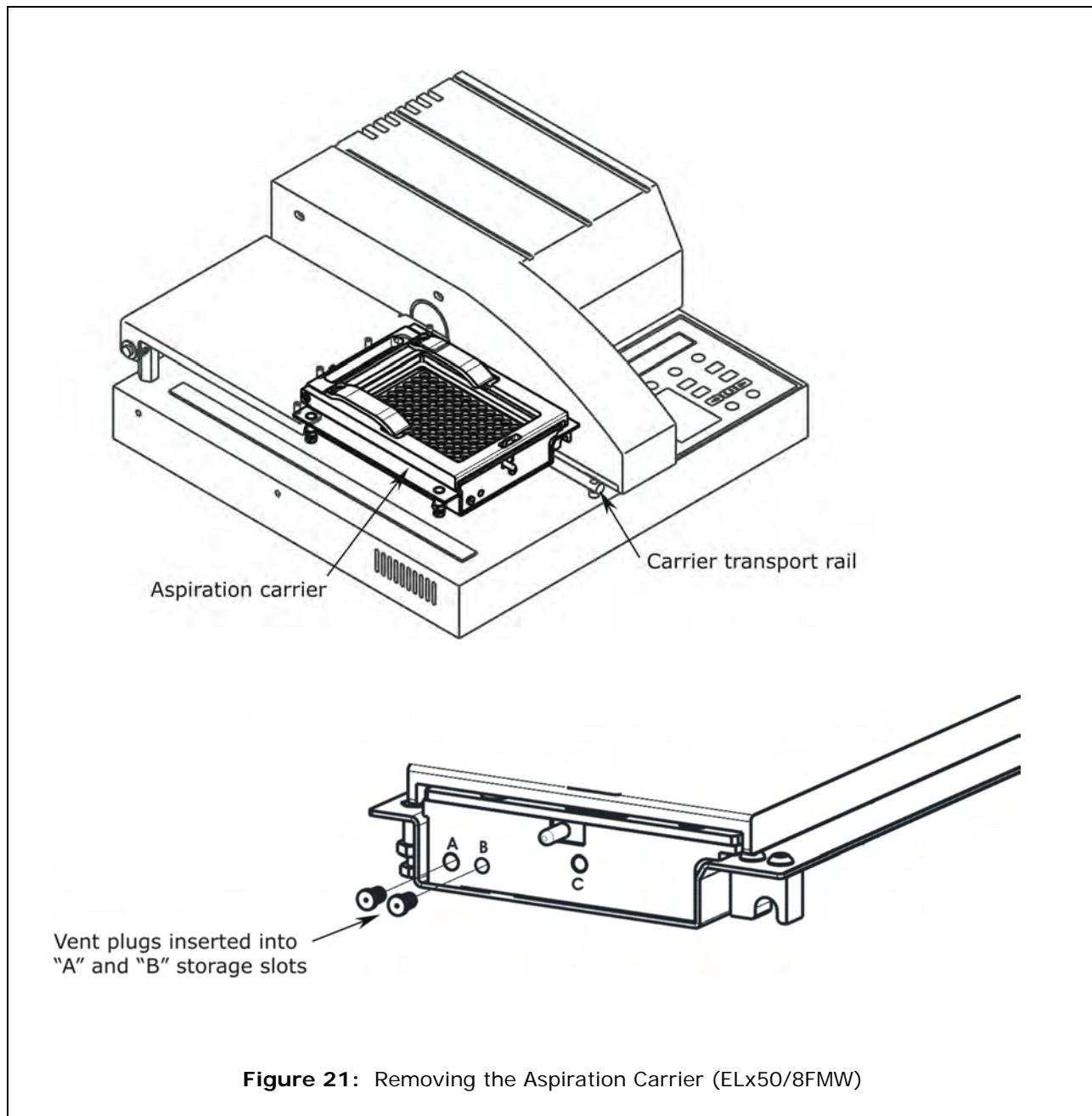


Figure 21: Removing the Aspiration Carrier (ELx50/8FMW)

Packing the 8-, 8s-, or 12-Channel Manifold in Its Container

1. Place the manifold into the foam shipping container as shown.
2. Wrap a large rubber band around the shipping block.
3. Place the shipping block into a plastic ziplock bag.

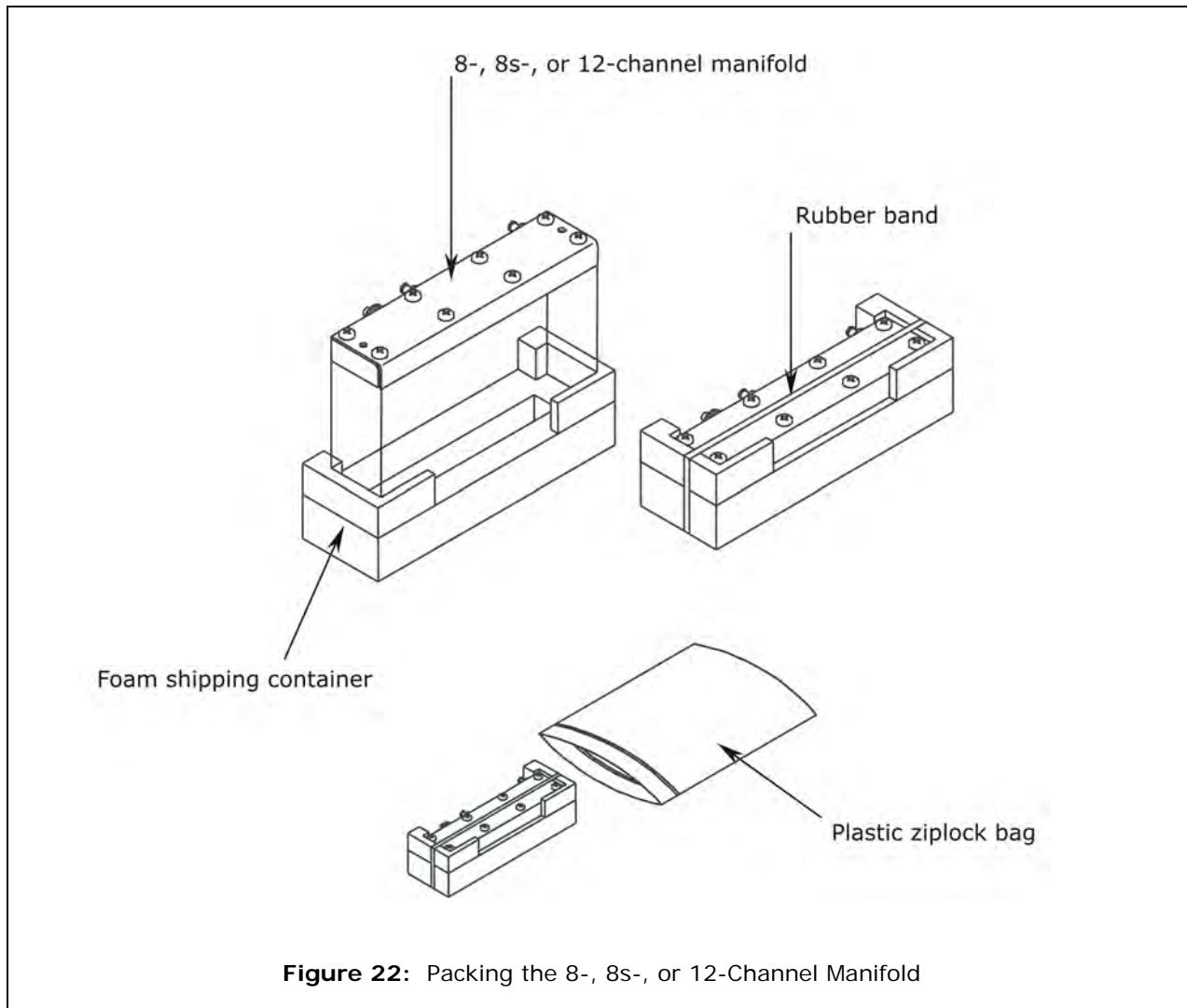


Figure 22: Packing the 8-, 8s-, or 12-Channel Manifold

Packing the 16-Channel Manifold in Its Container

1. Place the three thumbscrews into a small ziplock bag. Insert the bag into the hole in the bottom of the foam shipping container for the 16-channel manifold.
2. Place the manifold into a plastic bag.
3. Insert the bag into the container.

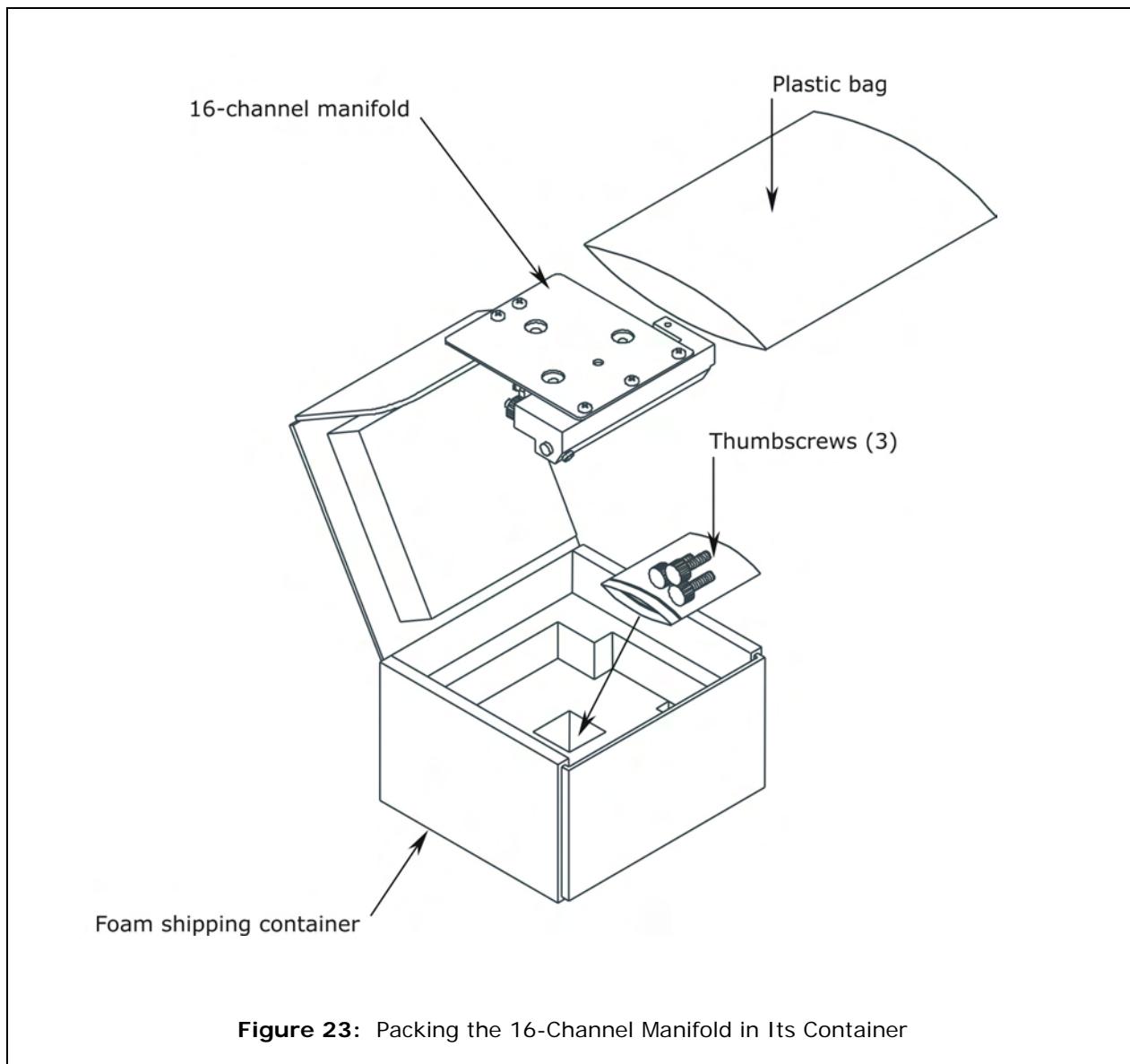


Figure 23: Packing the 16-Channel Manifold in Its Container

Rotating the Cam

1. Ensure that the mist shield, manifold, and carrier have been removed as instructed on the previous pages.
2. Rotate the cam until it is in the downward position, as shown below.

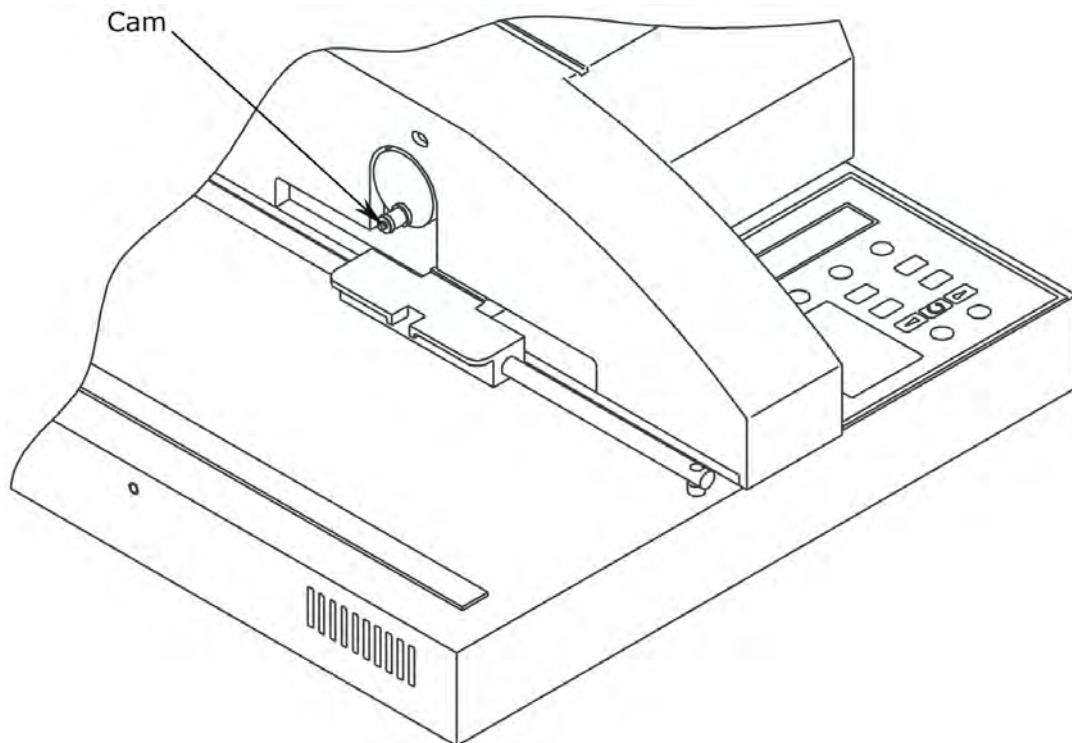


Figure 24: Rotating the Cam

Placing the Washer into the Inner Shipping Container

1. Ensure that the cam is in the down position as shown on the previous page.
2. Align the groove in the foam shipping block to the manifold mounting bracket and push the block onto the bracket.
3. Place the washer into a plastic bag.
4. Carefully lower the instrument into the inner shipping container, placing it all the way forward into the box.
5. Place insert #1 into the shipping container, as shown below.
6. Slide the washer all the way back to insert #1.
7. Place insert #2 into the front of the shipping container, as shown below.

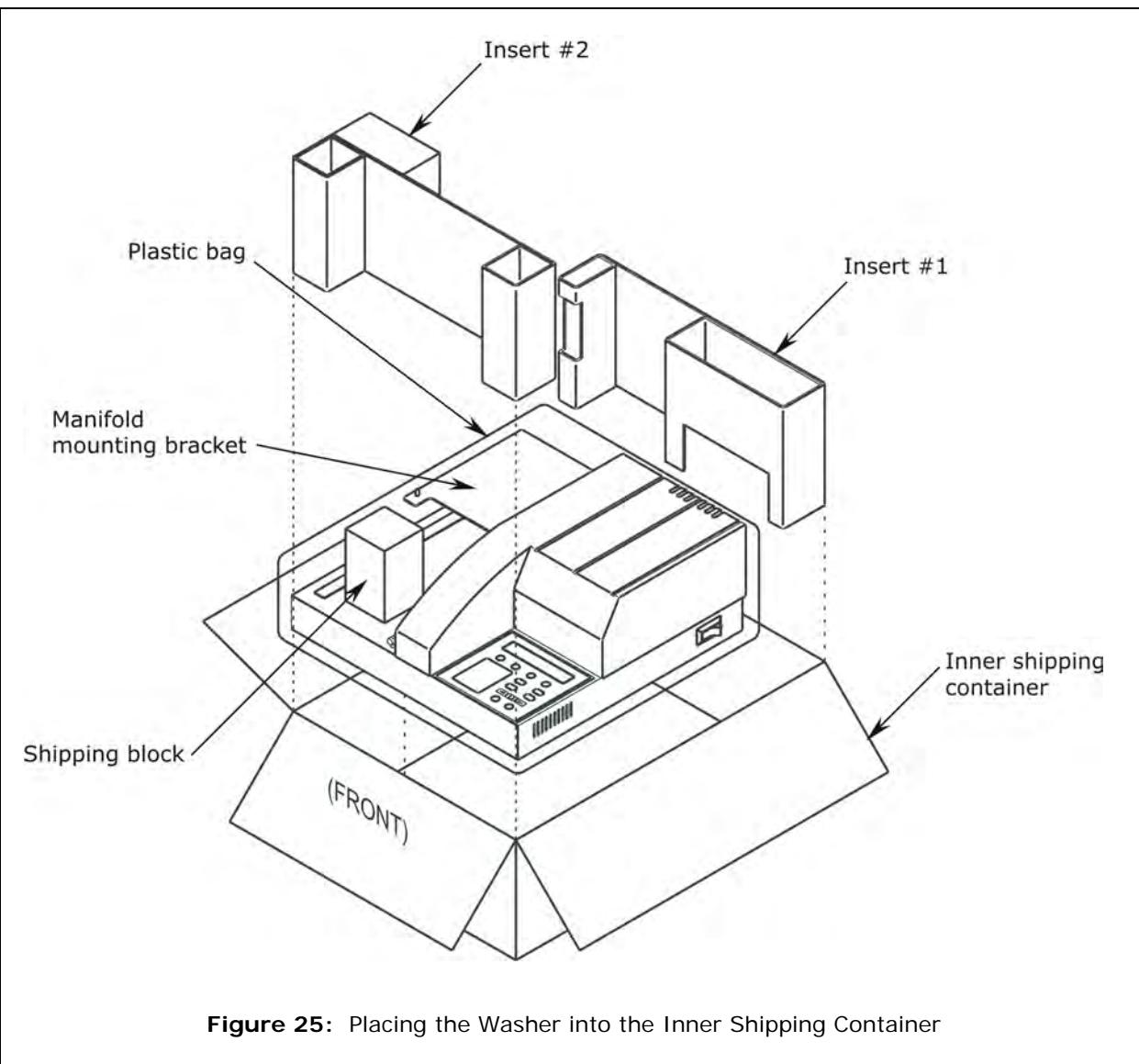


Figure 25: Placing the Washer into the Inner Shipping Container

Placing the Aspiration Carrier into the Inner Shipping Container

1. **ELx50™/8FMW model only:** Place the aspiration carrier in its compartment as shown.
2. Close the inner shipping container.

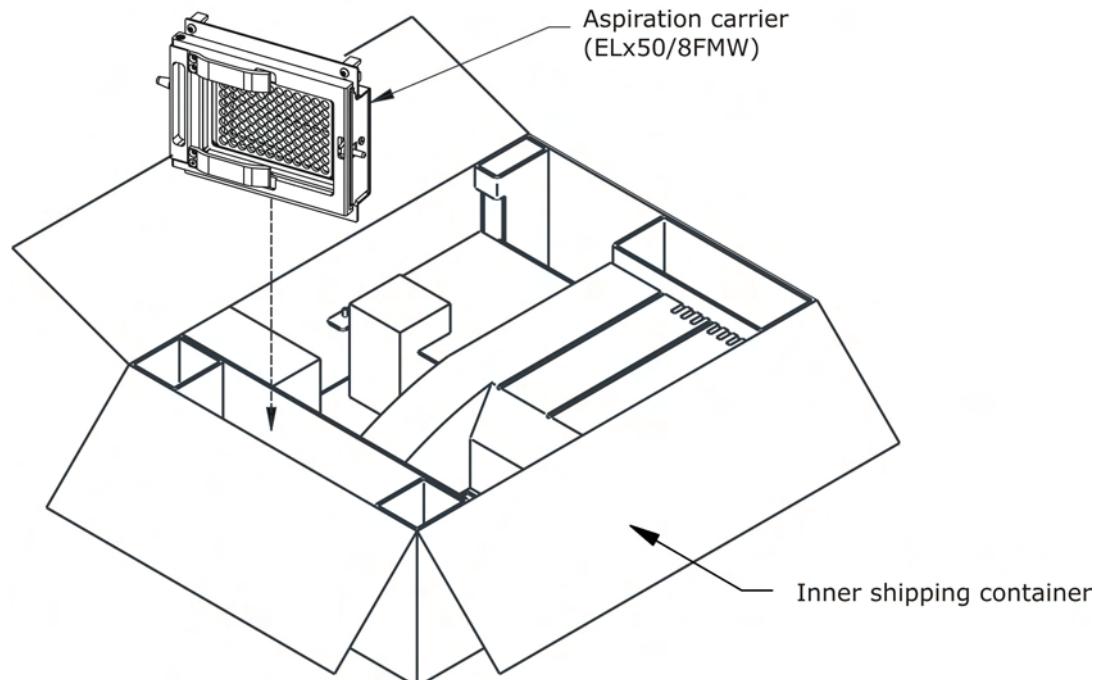


Figure 26: Placing the Aspiration Carrier (ELx50/8FMW) into the Inner Shipping Container

Packing the Inner Shipping Container

1. Place the eight foam corner blocks onto the inner container as shown.
2. Place the container into the outer shipping container.

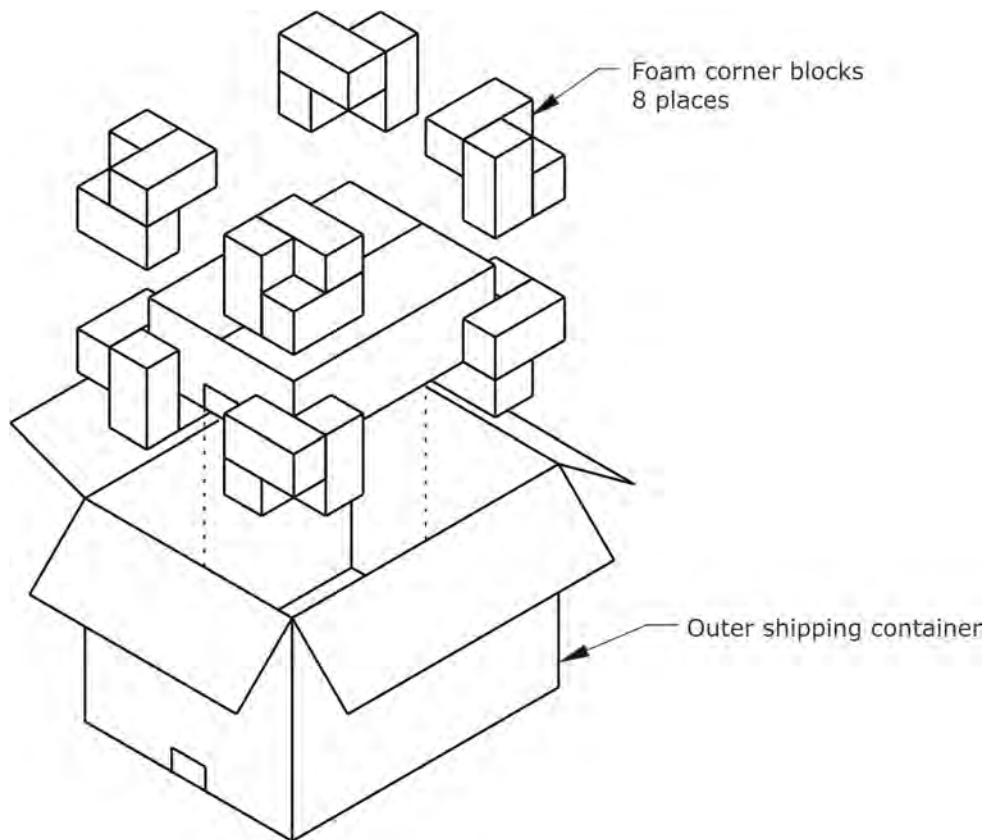


Figure 27: Packing the Inner Shipping Container

Packing the 16-Channel Manifold and Mist Shield

1. Slide the 16-channel manifold underneath the mist shield as shown.
2. Insert the mist shield and manifold into the top packing container.
3. Place the container on top of the inner shipping box.

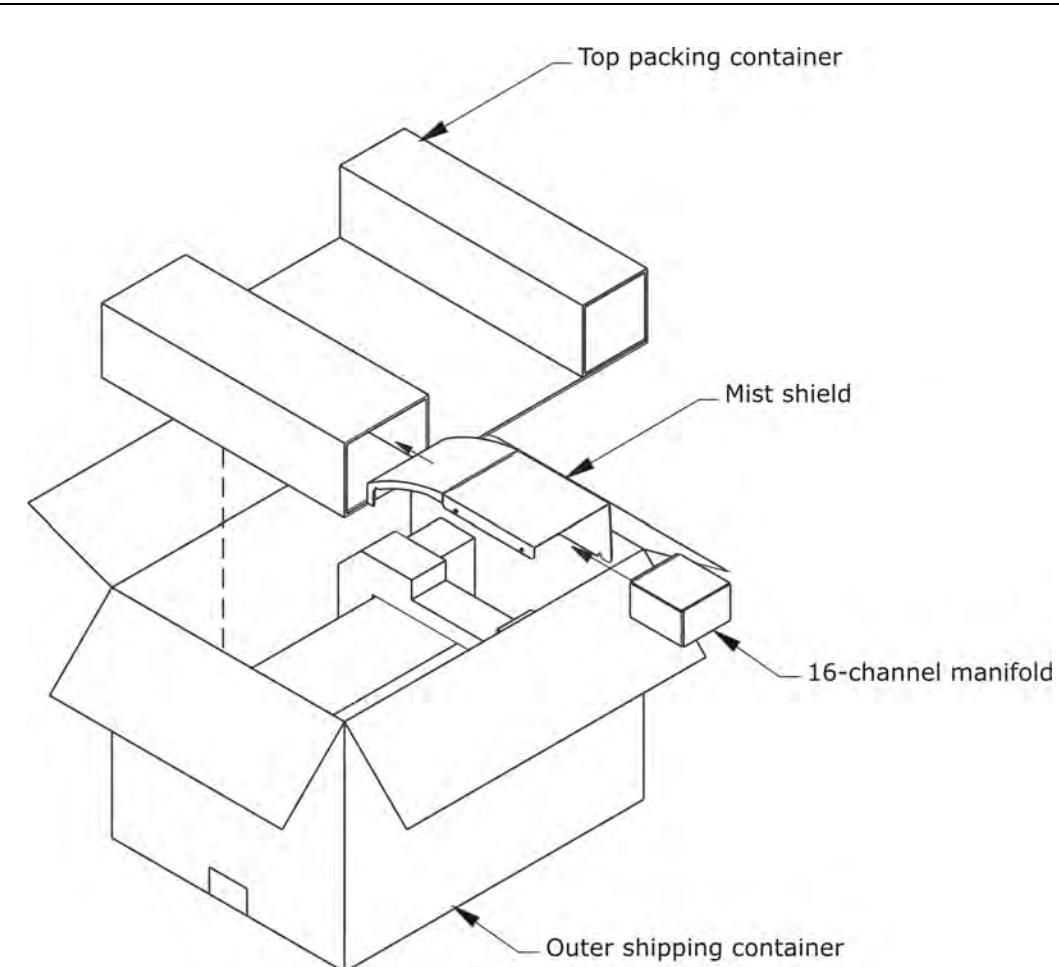


Figure 28: Packing the 16-Channel Manifold and Mist Shield

Packing the 8-, 8s-, or 12-Channel Manifold, Microplate Carrier, and Power Supply

1. Place the 8-, 8s-, or 12-channel manifold, microplate carrier, and power supply into the shipping tray as shown, then place into the outer shipping container.
2. Close the top of the outer shipping box and tape it shut.
3. Write "RMA" and the RMA number in large, clear letters on the outside of the shipping container and ship the instrument to the BioTek address provided in the **Product Support & Service** section of **Chapter 1**.

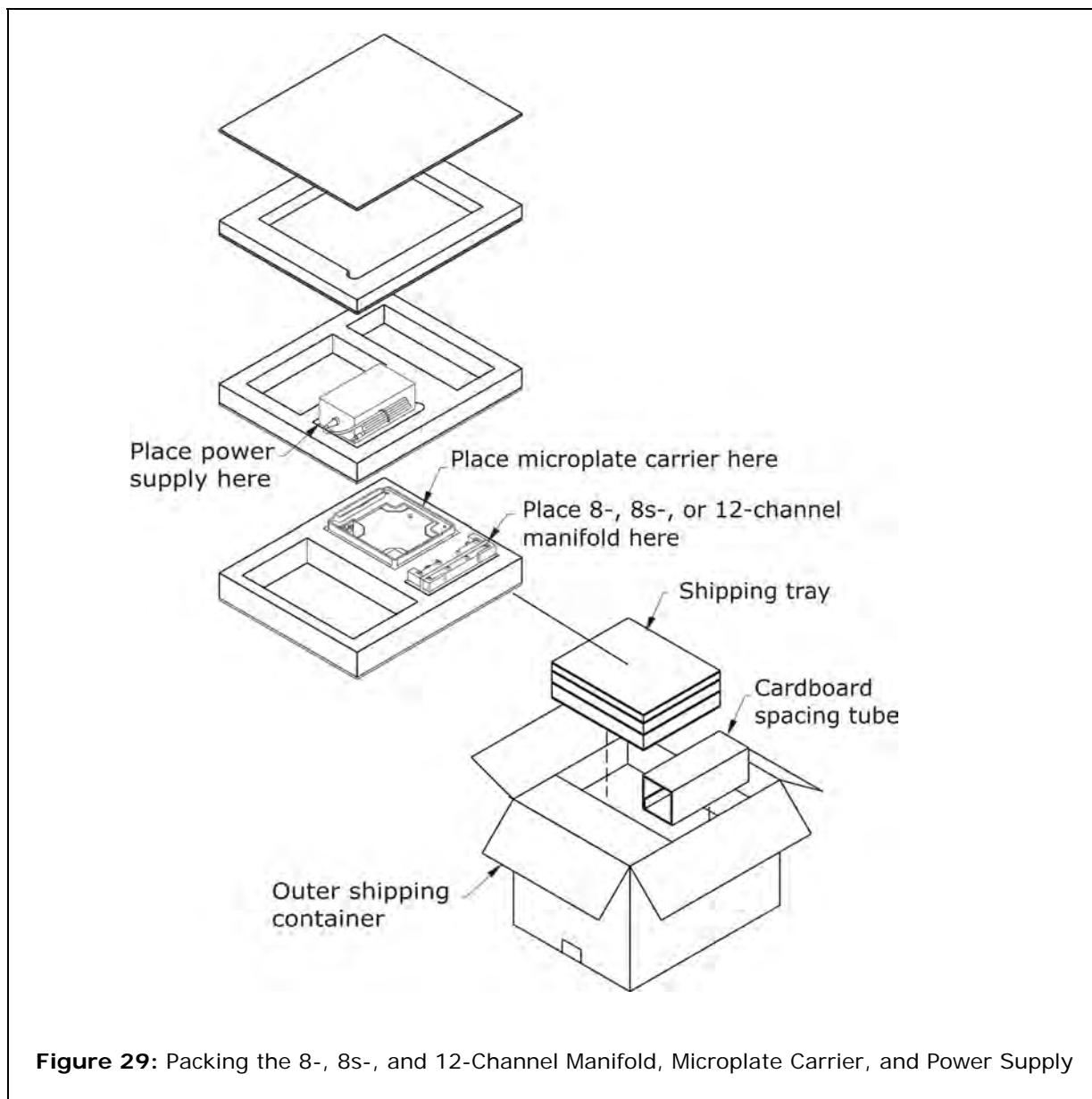


Figure 29: Packing the 8-, 8s-, and 12-Channel Manifold, Microplate Carrier, and Power Supply

Chapter 3

Operation

This chapter includes instructions for operating the ELx50™ Microplate Strip Washer and its software.

ELx50 Front Panel	52
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ELx50 Front Panel

The front panel on the ELx50™ Microplate Strip Washer features a 25-key keypad and a 2 x 24-character LCD display as shown in **Figure 30** below.

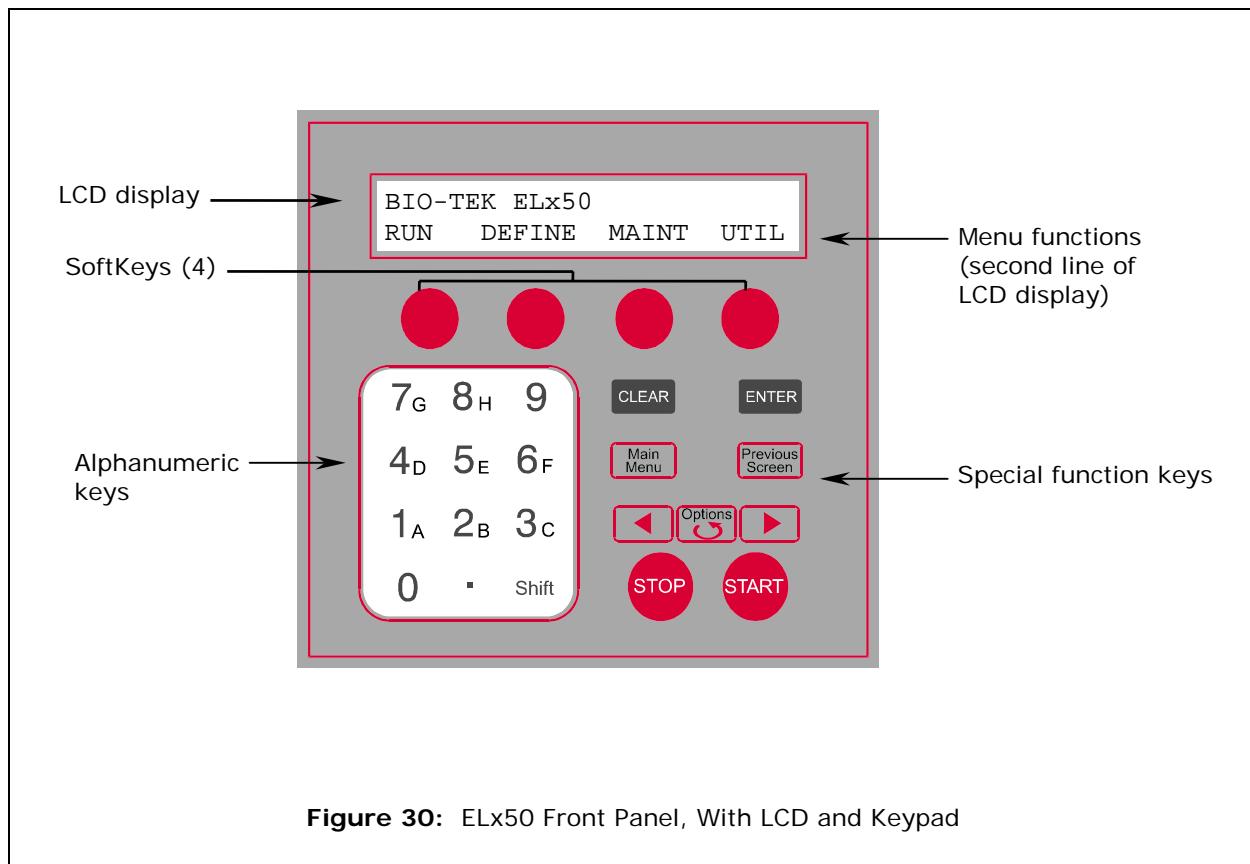
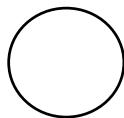


Figure 30: ELx50 Front Panel, With LCD and Keypad

Keypad Description



The keypad has four **SoftKeys**, one below each selectable menu option. Press a SoftKey to choose a menu selection. For example, from the **Main Menu**, press the leftmost SoftKey to select **RUN**, the rightmost to select **UTIL**.



Exit the current screen and return to the **Main Menu**. After defining a washer program, press the **Main Menu** key, then press **YES** to save the program.



To scroll through the different options within a program, press the **Options** key or the **Shift + Options** key combination. Press the **ENTER** key to select the current option.



Pressing **ENTER** generally saves the current screen settings and advances to the next screen in a series.



To move to a previous menu, press the **Previous Screen** key.



Press **CLEAR** to delete an entry.



Press the **◀** (reverse) arrow to move the cursor to the left in the LCD display.



Press the **▶** (forward) arrow to move the cursor to the right in the LCD display.



To start running a washer program, press the **START** key.



To stop running (abort) a washer program, press the **STOP** key.

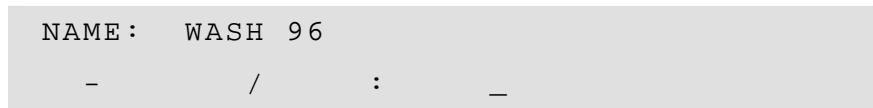
Entering Program Names

Each ELx50™ washer program requires the entry of a unique name, using up to 16 alphanumeric characters. To enter a program name via the washer keypad:

1. Press **Shift** + key **A-H**, or
2. Scroll through the alphabet with the Options key for **A-Z**.
3. Press **Shift** + **Options** to reverse direction.
4. Use the ► (forward) or ◀ (reverse) arrows to move the cursor within the display.
5. Press the **ENTER** key to store the completed program name and continue.

If the program name already exists, the washer software will require you to enter a unique name. This protects washer programs from inadvertently being overwritten.

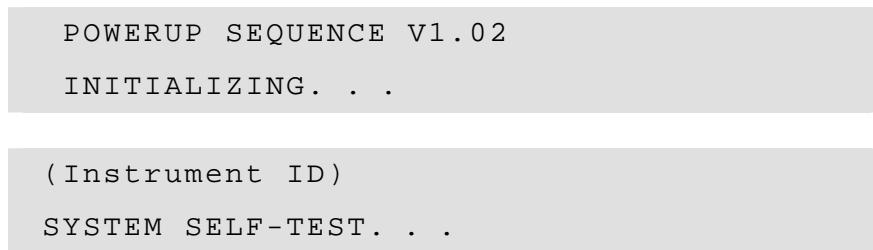
The **NAME** display offers four symbols that can be used in a program name: dash (hyphen), forward slash, colon, and underscore (see below). These symbols appear in the LCD as SoftKey choices. To include a symbol within a program name, press its corresponding SoftKey.



System Startup

To turn on the ELx50™, press the on/off switch on the right side of the base. The ELx50 will perform a self-test, displaying the screens shown below until initialization is complete. During this time, all keys are inactive.

If the self-test fails, the washer will “chirp” and display an error code. Press **STOP** to stop the chirp. Refer to **Chapter 5, Troubleshooting** and **Appendix A, Error Codes**, to interpret these codes. Contact BioTek Instrument’s Technical Assistance Center (see page 12), for further assistance with troubleshooting.

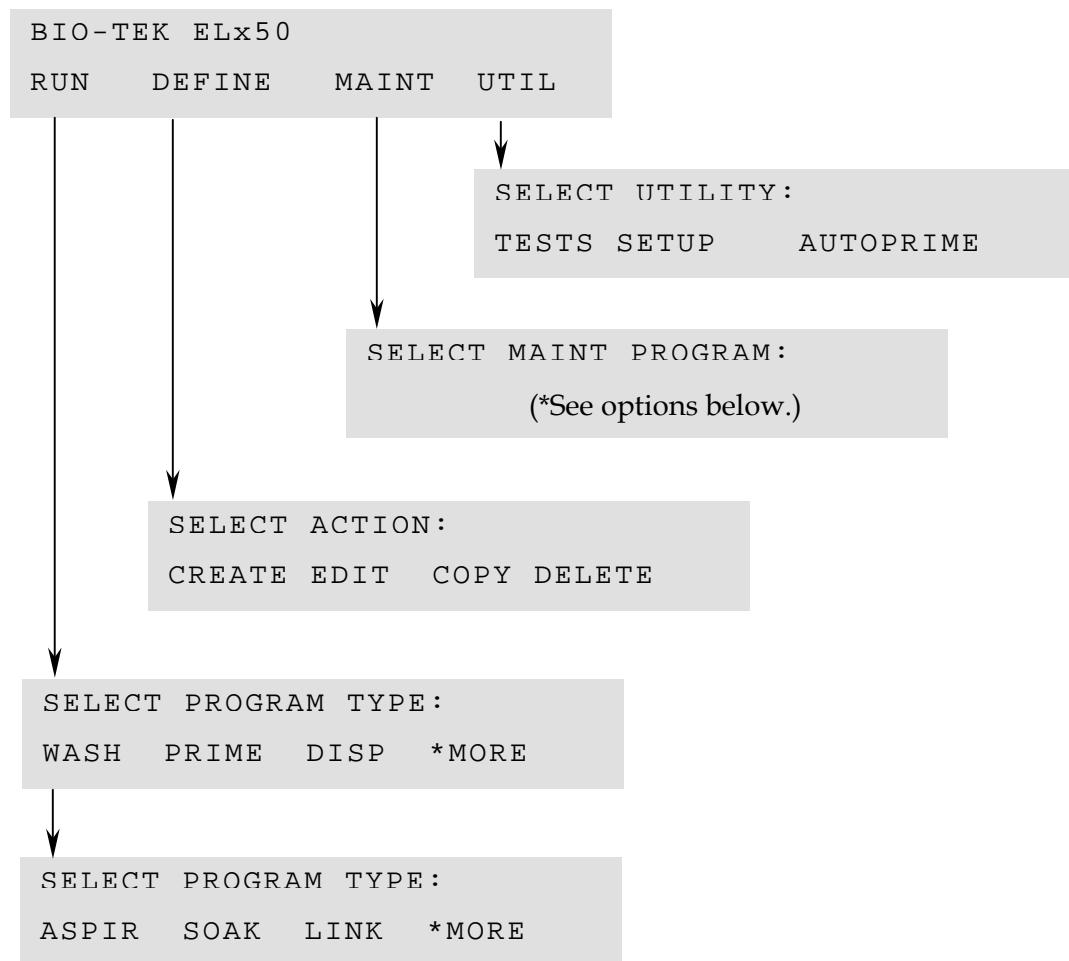


Main Menu

Following successful power-up of the ELx50™, the **Main Menu** appears:

```
BIO-TEK ELx50
RUN      DEFINE      MAINT      UTIL
```

The following options are available through the Main Menu. (See the **Washer Menu Maps** on pages 92 through 95 for a complete listing of menu options.)



*Maintenance options include:

DECONTAMINATION, LONG_SHUTDOWN, OVERNIGHT_LOOP,
RINSE_AND_SOAK, and DAY_RINSE.

General Usage Guidelines

	<p>Important! Please review the General Usage Guidelines before running any programs.</p>
	<p>Vacuum Filter: It is strongly recommended that you install the hydrophobic in-line vacuum filter before using the ELx50™. See Connecting the Tubes and Bottles in Chapter 2 for more information.</p>

When operating the washer, follow these guidelines to ensure optimal performance and to prevent the problems described in the troubleshooting charts in **Chapter 5, Troubleshooting**.

Before Running Any Program

- Fill the wash/rinse bottles with sufficient fluid. Make sure the supply tube is in the liquid.
- The supply tube should extend to the bottom of the bottle and be cut at the end (see drawing to the right) to ensure free flow of liquid at the bottom of the supply bottle.
- Empty the waste bottle and firmly seat the waste bottle's stopper. To ensure that fluid does not back up into the vacuum pump during operation, never allow the waste bottle to become more than three-quarters full.
- Check the external tubing connections for kinks and clogs.
- For washers with the aspiration carrier (ELx50/8FMW): when setting up the tubing from the aspiration carrier to the port on the back of the washer, ensure that there is sufficient room for the tubing.



Since the carrier moves in and out during a Dispense program, a clear tubing flex path needs to be maintained so that carrier motion is not impeded.

Pushing the instrument up against a wall or against the vacuum/dispense bottles can result in errors, because the carrier loses steps during movement. See **Chapter 2, Installation**, for illustrations of proper tubing connections.

- Make sure the bottles, solutions, and tubing are clean and do not contain any particles or mold. Water and dye solutions that are recycled over several days will grow algae, bacteria, molds, or other undesirable organisms.
- If there are large air pockets in the tubing, run a Prime program using 200 ml before running another program.

- To avoid creating air bubbles every time the wash or rinse bottle is filled, make a mark halfway down the bottle and refill when the fluid level has dropped to that point. Unscrew the cap and let it hang over the side just enough to avoid emptying the inside tube and enough to refill the bottle.
- When placing a microplate on the carrier, make sure that well A1 is in the right rear corner as you face the front of the washer, and that the plate is firmly seated in the carrier. The microplate carrier has a microplate spring that holds the microplate against the front edge of the carrier. The aspiration carrier in the ELx50™/8FMW model has a plate clamp for securing the microplate in place. (See **Chapter 2, Installation**, for illustrations of the microplate and aspiration carriers.)
- Ensure that you are using the correct microplate/microstrip types:
 - 8-, 8s-channel manifold: 96-well plates, 8-well strips.
 - 12-channel manifold: 96-well plates, 12-well strips.
 - 16-channel manifold: 96- or 384-well plates, 8-well strips.
 - Aspiration carrier (ELx50/8FMW): 96-well filter-bottom microplates only. Microstrips are not supported.
- When placing microstrips on the carrier, always load the strips starting with position one in the holder closest to the rear of the instrument.
- **Vacuum control for the aspiration carrier:** Make sure that there is enough vacuum for aspiration. Use the vent port (labeled "C") on the carrier and the two vent plugs (located in storage slots "A" and "B") to vary the vacuum levels. (See **Figure 10** in **Chapter 2** for an illustration of the vent port and the two vent plugs.)

The vent port is a 0.047" diameter hole, which is equal to approximately -64 mmHg. The gray vent plug contains a 0.032" diameter hole, which is equal to approximately -116 mmHg. The black vent plug contains a 0.020" diameter hole, which is equal to approximately -240 mmHg.

❖ The approximate vacuum levels listed above (-64, -116, and -240 mmHg) are "typical" only, and may vary, depending upon factors such as relative humidity, barometric pressure, and mechanical tolerances.

- For a **low** vacuum level, leave the vent port on the carrier **open**.
- For a **medium** vacuum level, insert the **gray** vent plug into the vent port.
- For a **high** vacuum level, insert the **black** vent plug into the vent port.



Important! Ensure that the vent port is not completely sealed. If the vent port is sealed, the washer's internal vacuum pump may collapse the vacuum reservoir bottle.

Maintenance

Perform Daily, Overnight, and Periodic Maintenance as described in **Chapter 4, Maintenance and Performance Verification (IQ/OQ/PQ)**. Periodic Maintenance includes:

- Cleaning the manifold tubes and chambers.
- Cleaning the plate carrier.
- Cleaning the supply, rinse, and waste bottles.
- Rinsing and checking the tubing and the check valves.

Frequent inspection of the washer, tubing, and bottles for the possible causes listed below may help to eliminate many of the problems listed in **Chapter 5, Troubleshooting**.

- **Loose or incorrect connections** of power supply, waste and supply tubing and fittings.
- **Incomplete or incorrect installation** of manifold and carrier, **attachment** of mist shield, or **placement** of microplate/microstrips in carrier.
- **Accumulation of residue** on carrier or inside aspirate/dispense tubes, waste/supply bottles and tubing, manifold, inlet/outlet fittings, optional in-line vacuum filter, or optional vacuum pump muffler (washers manufactured after January 2008).
- **Worn** tubing, o-rings, inlet or outlet fittings, manifold gaskets or vacuum seals.
- **Kinked or bent** aspirate/dispense tubes or waste/supply tubing.

Programming Considerations

- Be sure to enter the correct 'First Strip' and 'Number of Strips' values at run-time.
- Ensure that the correct manifold type (8-, 8s-, 12-, or 16-) has been specified (by selecting **UTIL > SETUP**) and is in use.
- Washers with the multiple valve tubing option ("V" version washers): Ensure that the correct reagent bottle is selected (A, B, or C).
- The dispense (overflow) height in the wash protocol should be low enough to ensure that excess fluid is removed by the aspirate tubes when the manifold is dispensing.
- **Plate type for the 16-channel manifold:** Ensure that the correct plate type (96 or 384) is specified when selecting the Define Wash program options.
- When editing, copying, deleting, running, or linking programs, the list of programs displayed is dependent on the manifold configurations. For example:

- If an 8-channel manifold is configured, then the list of programs available for editing, copying, deleting, running, or linking will not contain 12-channel or 16-channel programs.
- The option to perform a bottom aspirate using the aspiration carrier (ELx50™/8FMW model) is only available when the instrument is configured with either the 8- or 8s-channel manifold. Aspirate-only programs containing a bottom aspiration sequence will not be displayed in the program list, if a 12-channel manifold is configured.
- **Bottom aspiration time:** When you are using the aspiration carrier in the ELx50/8FMW washer, ensure that you do not define a bottom aspiration time (BOT ASPIRATE TIME) that is too long for your assay type. Long aspiration times may cause beads to stick to the bottom of the wells in the filter-bottom plates. Try shorter aspiration times (e.g., 10 seconds) *initially*, and then increase the aspiration time until suitable aspiration is achieved. You may also wish to vary the vacuum levels by using the vent port on the aspiration carrier and the two vent plugs. Refer to the instructions for using the vent port and plugs in “Vacuum control for the aspiration carrier” on page 57.

Liquid Level Alert™ Option

ELx50 washers manufactured after October 2007 support the Liquid Level Alert option. With this option, each bottle has a level sensing device inside. When a supply bottle's fluid level drops to approximately 400-450 mL, or the waste bottle's fluid level rises to approximately 1400-1450 mL, a sensor will activate.

The washer checks the status of the sensor at the start of all programs and also at the end of Wash and Dispense programs. If a sensor has been activated, an error code (2800 or 2900) will appear on the display. If this happens, press the STOP key and then select ABORT or CONTINUE. If you choose to continue running a program, it is your responsibility to ensure that the supply bottle contains enough fluid to process the plate.

Sensor detection is *enabled* on the washer by default. You can disable it, but you will be responsible for observing the fluid levels in the bottles. To view or change the sensor detection setting, see page 90.

Wash

This section discusses how to run, define, edit, copy, and delete **Wash** programs.

Run Wash Program

- ❖ Before running any program, make sure that the microplate or the holder containing the microstrips is properly seated in the plate carrier.

To run a Wash program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
RUN → WASH → SELECT WASH PROGRAM → SELECT
REAGENT BOTTLE* → PRIME THE WASHER? → SELECT
PRIME PROGRAM → FIRST STRIP → NUMBER OF STRIPS
→ PLACE PLATE IN CARRIER AND PRESS <START> KEY
→ WASH PROGRAM RUNNING. PRESS <STOP> KEY TO QUIT
→ WASH PROGRAM COMPLETE. PRESS <ENTER> KEY
```

* SELECT REAGENT BOTTLE only appears on the "V" version washers.

Run Wash Program Options

Options	Actions
Wash program	Select a Wash program. Note: For washers with dual-configuration for switching between the 16- and 8-channel manifolds, only those programs defined under the current configuration will be presented for selection. For example, if you are currently using the 16-channel manifold, only those programs that were defined with the 16-channel configuration will be displayed.
Select Reagent Bottle	Select the reagent bottle from which to dispense. This applies only to "V" version models.
Prime?	Select a prime program to run before starting the wash program.
First Strip	Specify the number of the first strip to be washed.
Number of Strips	Specify the number of microwell strips to be washed (the actual selectable range is based on the First Strip value): 1 to 12 for the 8- or 8s-channel manifold 1 to 8 for the 12-channel manifold 1 to 24 for the 16-channel manifold

Define Wash Program

To define a Wash program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → CREATE → WASH → NAME → PLATE TYPE*
→ DEFINE WASH COMPONENT → Select the Program
Component (Method, Dispense, Aspiration) →
Press MAIN MENU KEY to end → OK TO SAVE
PROGRAM?
```

* PLATE TYPE only appears if the washer is configured with the 16-channel manifold.

Define Wash Program Options

Options	Actions
Name	Enter a unique name for the Wash program, using up to 16 alphanumeric characters. See Entering Program Names on page 54 for instructions.
Plate Type	Select a Plate Type of 96 if washing 8-well strips or 96-well plates, or 384 if washing 384-well plates (for washers configured with the 16-channel manifold).
Wash Component	METHOD: Wash cycles, plate or strip format, soaking and shaking, soak duration, shake before soak, shake duration, shake intensity, prime after soak, prime volume and prime flow rate. The fields are described in the Method table, page 62. DISP: Dispense Volume, Dispense Flow Rate, Dispense Height, Horizontal Dispense Position, Bottom Wash First, Bottom Dispense Volume, Bottom Flow Rate, Bottom Dispense Height, Bottom Horizontal Position, Prime Before Start, Prime Volume, Prime Flow Rate. The fields are described in the Dispense table, page 64. ASPIR: Aspirate Height, Horizontal Aspirate Position, Aspirate Rate, Aspirate Delay, Crosswise Aspirate, Crosswise On, Crosswise Height, Crosswise Horizontal Position, Final Aspiration, Final Aspirate Delay. The fields are described in the Aspiration table, page 67.
Press Main Menu to end	After all wash components have been programmed, press Main Menu then select YES to save the program.

Define Wash METHOD Program Options

Options	Actions
Number of Cycles	<p>Specify 1 to 10 complete wash cycles. A complete wash cycle represents an aspirate and dispense sequence, which may or may not end with a final aspiration of the liquid from the wells (see Final Aspiration? in the Define Wash ASPIRATION Program Options table, page 67.)</p> <p>Note: If Bottom Wash is enabled, an additional aspirate and dispense sequence is performed using unique bottom washing dispense parameters (see Bottom Wash First? in the Define Wash DISPENSE Program Options table, page 64).</p>
Wash Format	<p>Choose Plate or Strip wash format.</p> <p>Plate format applies each cycle to the entire plate (or all of the strips) before it starts the next cycle. Strip format applies all cycles to one strip before it moves to the next strip.</p> <p>Note: The number of strips to wash is defined at program run-time.</p>
Soak/Shake?	Choose YES to soak and/or shake the wash buffer in the microwells after the buffer has been dispensed.
Soak Duration	<p>Soak Duration represents the time to allow the wash buffer to remain in the wells before aspiration. The duration range is from 0 to 600 seconds.</p> <p>A soak begins after the wash buffer is dispensed to the wells. In some chemistries it enhances washing by allowing unbound material to diffuse into the wash buffer. When washing strips in a plate format use a soak that lasts as long as it takes to process one wash cycle of all strips.</p>
Shake Before Soak?	<p>Choose YES to agitate the microwells back and forth linearly along the carrier track to aid in dispersal.</p> <p>Before the microwells begin shaking, the manifold raises so that the dispense and aspirate tubes clear the microwells. The carrier returns to its home position so that the tubes are above the carrier trough.</p>
Shake Duration	Shake Duration represents the length of time that the microwells are agitated. The duration range is from 1 to 600 seconds.
Shake Intensity	Specify the intensity of microwell shaking. The options range from 1 to 5, where 1 = Least Intense, 5 = Most Intense. The washer display shows the corresponding cycles/sec value for each option.
Prime After Soak?	Choose YES to prime the dispense tubes after a soak cycle.
Prime Volume	Specify the volume, in milliliters, of the solution used to prime the dispense tubes. The volume range is from 1 to 200 ml.

Options	Actions
Prime Flow Rate	Specify the rate at which the priming fluid will be pumped into the dispense tubes. The flow rate options range from 1 to 9 (1 to 7 for the 12-channel manifold), where 1 = Slowest, 9 = Fastest. The washer display shows the corresponding $\mu\text{l}/\text{well}/\text{sec}$ value for each option.
Press ENTER to continue	Define another wash component.
Press Main Menu to end	Select YES to save the program.

Wash METHOD Defaults and Ranges

Parameter	Default	Range	Units
Number of Cycles	3	1-10	
Wash Format	Plate	Plate/Strip	
Soak/Shake?	No	Yes/No	
Soak Duration	30	0-600	seconds
Shake Before Soak?	No	Yes/No	
Shake Duration	5	1-600	seconds
Shake Intensity	3	1-5	1 = 15 cycles/second 2 = 16 3 = 17 4 = 18 5 = 19
Prime After Soak?	No	Yes/No	
Prime Volume	5	1-200	milliliters
Prime Flow Rate	5	1-9 (1-7 for the 12-channel manifold)	Selection = Flow rate in $\mu\text{l}/\text{well}/\text{second}$ 8/8s 12 16 1 = 150 150 225 2 = 200 200 250 3 = 300 300 300 4 = 450 450 325 5 = 500 500 350 6 = 600 600 375 7 = 650 650 400 8 = 800 ----- 450 9 = 1000 ----- 500

Define Wash **DISPENSE (DISP)** Program Options

❖ **Note:** The shaded options are **not** available for Dispense-only programs or for washers configured with 16-channel manifolds.

Options	Actions
Dispense Volume	<p>Specify the volume of wash solution to dispense per microwell, per wash cycle. The volume range is 50 to 3000 μl/well for the 8-channel, 8s-channel, 12-channel manifolds, as well as for the 16-channel manifold, but only when it is dispensing to 96-well plates. For the 16-channel manifold dispensing to 384-well plates, the range is 25-3000 μl/well.</p> <p>Note: During program creation, it is possible to enter a Dispense Volume/Flow Rate combination that is invalid for the current washer manifold type. The ELx50™ basecode performs validation of these parameters at program run-time only—if the configuration is found to be invalid, the OF00 error will display. See Dispense Volume Invalid for Manifold Type (OF00 Error) in Appendix A for a table showing valid Dispense Volume ranges for each Dispense Flow Rate / Washer Manifold combination. (The same table is also included on page 66.)</p>
Dispense Flow Rate	<p>Specify the rate at which the dispense fluid is dispensed from the tubes. The flow rate options range from 1 to 9 (1 to 7 for the 12-channel manifold), where 1 = Slowest, 9 = Fastest. The washer display shows the corresponding μl/well/sec value for each option.</p>
Dispense Height (Overflow Position)	<p>Dispense Height represents the height between the bottom of the aspirate tubes and the carrier surface on which the plate rests, during the dispense part of a wash cycle. See Figure 31 on page 70.</p> <p>The Dispense Height options range from 12 to 180. The washer display shows the corresponding measurement in millimeters for each option.</p> <p>12 is the closest to the carrier surface, and 180 is the furthest from this surface. The dispense tubes are shorter than the aspirate tubes.</p> <p>Note: It is considered good practice to set a dispense height that positions the aspirate tubes at the top of wells to draw off any overflow.</p>
Horizontal Disp Pos	<p>Horizontal Dispense Position represents the position of the manifold tube in relation to the center of the microwell.</p> <p>The Horizontal Disp Pos options range from: -24 to 24 for the 8- and 12-channel manifolds; -88 to 24 for the 8s-channel; -24 to 15 for the 16-channel, 96-well plates; and -22 to 10 for the 16-channel, 384-well plates.</p>

Options	Actions
(Horizontal Disp Pos)	<p>The washer display shows the corresponding measurement in millimeters for each option.</p> <p>A negative offset (-24 to -1) moves the dispense tubes away from the front edge of the well. A positive offset (1 to 24) moves the dispense tubes toward the front edge of the well. A setting of 0 indicates no offset (0.000 mm).</p>
Bottom Wash First?	<p>Bottom washing consists of an initial dispense/aspirate sequence, adding another wash cycle to the defined number of cycles. The manifold is positioned at the defined Bottom Disp Height. The reagent is simultaneously dispensed and aspirated at this height to create cleaning turbulence. The manifold descends to aspirate again and ends with a final dispensing of fluid to fill the well.</p>
Bottom Disp Volume	<p>Specify the volume of wash solution to dispense per microwell during the bottom wash. The volume range is 50 to 3000 μl/well.</p>
Bottom Flow Rate	<p>Specify the rate at which the dispense fluid is dispensed from the tubes during the bottom wash. The flow rate options range from 1 to 9 (1 to 7 for the 12-channel manifold), where 1 = Slowest, 9 = Fastest. The washer display shows the corresponding μl/well/sec value for each option.</p>
Bottom Disp Height	<p>Bottom Dispense Height represents the height between the bottom of the aspirate tube and the carrier surface on which the plate rests, during the wash. See Figure 31 on page 70.</p> <p>The Bottom Disp Height options range from 12 to 180. The washer display shows the corresponding measurement in millimeters for each option.</p> <p>12 is the closest to the carrier surface; 180 is the furthest. The dispense tubes are shorter than the aspirate tubes.</p>
Bottom Horiz Pos	<p>See the description for Horizontal Disp Pos in this table. The only difference is that Bottom Horizontal Pos specifically refers to Bottom Washing.</p>
Prime Before Start?	<p>Select YES to prime the dispense tubes before starting the wash program.</p>
Prime Volume	<p>Specify the volume of the buffer or rinse used to prime the dispense tubes. The volume range is 1 to 200 ml.</p>
Prime Flow Rate	<p>Specify the rate at which the priming fluid is pumped into the dispense tubes. The flow rate options range from 1 to 9 (1 to 7 for the 12-channel manifold), where 1 = Slowest, 9 = Fastest. The washer display shows the corresponding μl/well/sec value for each option.</p>
Press Enter to continue	<p>Define another wash component.</p>
Press Main Menu to end	<p>Select YES to save the program.</p>

Wash DISPENSE Defaults and Ranges

Parameter	Default	Range	Units
Dispense Volume*	300	25-3000 (16-channel manifold, 384-well plates) 50-3000 (8-, 8s-, and 12-channel manifold; 16-channel manifold, 96-well plates)	µl/well
Dispense Flow Rate*	5	1-9	µl/well/sec
Dispense Height	120	12-180	
Horizontal Dispense Position	0	-88 to 24**	quarter steps (in mm)
Bottom Wash First?	No	Yes/No	
Bottom Dispense Volume	300	50-3000	µl/well
Bottom Flow Rate	5	1-9	µl/well/sec
Bottom Dispense Height	60	12-180	
Bottom Horizontal Position	0	-88 to 24**	quarter steps (in mm)
Prime Before Start?	No	Yes/No	
Prime Volume	5	1-200	milliliters
Prime Flow Rate	5	1-9	µl/well/sec
* Refer to the table below for valid Dispense Volume/Flow Rate combinations.			
** Horizontal Dispense Position and Bottom Horizontal Dispense Position are model-specific: -24 to 24 (8- and 12-channel manifold); -88 to 24 (8s-channel manifold); -24 to 15 (16-channel manifold, 96-well plates); -22 to 10 (16-channel manifold, 384-well plates)			

Dispense Flow Rate	Dispense Volume Range (µl/well) by Manifold Type			
	8-Channel	12-Channel	16-Channel	
			96-well plate	384-well plate
1	50-3000	50-3000	50-3000	25-3000
2	50-3000	50-3000	50-3000	25-3000
3	50-3000	50-3000	50-3000	25-3000
4	50-3000	50-3000	56-3000	28-3000
5	50-3000	60-3000	60-3000	30-3000
6	50-3000	70-1100	90-3000	45-3000
7	55-3000	70-1100	100-3000	50-3000
8	100-1100	not valid	106-3000	53-3000
9	110-1100	not valid	110-3000	55-3000

Define Wash ASPIRATION (ASPIR) Program Options

- ❖ **Note:** The shaded options are **not** available for Aspirate-only programs.
- ❖ **Note:** Bottom aspiration using the aspiration carrier (ELx50™/8FMW washer) is not available for Wash programs.

Options	Actions
Aspirate Height	<p>Aspirate Height represents the height between the bottom of the aspirate tubes and the carrier surface on which the plate rests when aspirating the microwells. See Figure 31 on page 70.</p> <p>The Aspirate Height options range from 12 to 180. The washer display shows the corresponding measurement in millimeters for each option.</p> <p>12 is the closest to the carrier surface, 180 is the furthest from the surface. The aspirate tubes are longer than the dispense tubes.</p>
Horizontal Aspir Pos	<p>Horizontal Aspirate Position represents the position of the manifold tube in relation to the center of the microwell. The Horizontal Aspir Pos options range from: -24 to 24 for the 8- and 12-channel manifolds; -24 to 88 for the 8s-channel; -15 to 24 for the 16-channel, 96-well plates; and -10 to 22 for the 16-channel, 384-well plates. The washer display shows the corresponding measurement in millimeters for each option.</p> <p>A negative offset (-24 to -1) moves the aspirate tubes toward the rear edge of the well. A positive offset (1 to 24) moves the aspirate tubes away from the rear edge of the well. A setting of 0 indicates no offset (0.000 mm).</p> <p>Note: For flat-bottom plates, position the aspirate tubes near the edge of the well for minimal residual volume.</p>
Aspirate Rate	<p>Specify the rate at which the washer manifold travels down into the wells.</p> <p>The Aspirate Rate options range from 1 to 7, where 1 = Slowest, 7 = Fastest. The washer display shows the corresponding mm/sec value for each option.</p>
Aspirate Delay	<p>Aspirate Delay represents the time delay starting when the tube is at its aspiration height and ending when it next moves. The Aspirate Delay range is 0 to 5000 milliseconds.</p> <p>The delay applies to the normal (initial) aspiration if Crosswise Aspirate is not enabled. If Crosswise Aspirate is enabled, the delay applies to the crosswise, not the normal initial, aspiration.</p>

Options	Actions
Crosswise Aspir?	A crosswise aspiration is a two-step aspiration. The wells are first aspirated at the horizontal aspirate position. The aspirate tubes raise a fixed number of steps and then do a second (crosswise) aspiration at the crosswise horizontal position. The purpose is to eliminate residual sample or reagent from the wall perimeter. Select YES to designate a second aspiration.
Crosswise On	Select ALL to perform a crosswise aspiration on all aspirations, or FINAL to perform the crosswise aspiration on just the final aspiration.
Crosswise Height	Crosswise Height applies to a second or final aspiration. This is the height between the bottom of the aspirate tube and the carrier surface on which the plate rests. See Figure 31 on page 70. The Crosswise Height options range from 12 to 180. The washer display shows the corresponding measurement in millimeters for each option. 12 is the closest to the carrier surface, 180 is the furthest from the surface. The aspirate tube is longer than the dispense tube.
Crosswise Horiz Pos	Crosswise Horizontal Position applies to a second aspiration. See Horizontal Aspir Pos, on the previous page, in this table. The only difference is that Crosswise Horiz Pos specifically refers to crosswise aspirations.
Final Aspiration?	Select YES to designate a final aspiration, leaving the wells empty.
Final Aspir Delay	Final Aspiration Delay represents the time delay starting when the tube is at its final aspiration height and ending when it next moves. The Final Aspir Delay range is 0 to 5000 milliseconds.
Press Enter to continue	Define another wash component.
Press Main Menu to end	Select YES to save the program.

❖ **Note:** The shaded options are **not** available for Aspirate-only programs.

Wash ASPIRATE Defaults and Ranges

Parameter	Default	Range	Units
Aspirate Height	24	12-180	
Horizontal Aspirate Position	0	-24 to 88*	quarter steps (in mm)
Aspirate Rate	3	1-7**	
Aspirate Delay	0	0-5000	milliseconds
Crosswise Aspirate	No	Yes/No	
Crosswise On	Final	All/Final	
Crosswise Height	24	12-180	
Crosswise Horizontal Position	0	-24 to 88*	quarter steps (in mm)
Final Aspirate	Yes	Yes/No	
Final Aspirate Delay	0	0-5000	milliseconds
*Horizontal Aspirate Position and Crosswise Horizontal Position are model-specific: -24 to 24 (8- and 12-channel manifold) -24 to 88 (8s-channel manifold) -15 to 24 (16-channel manifold, 96-well plates) -10 to 22 (16-channel manifold, 384-well plates)		**Aspirate Rate (mm/sec): 1 = 05.0 2 = 05.2 3 = 05.8 4 = 06.7 5 = 08.0 6 = 10.7 7 = 16.0	

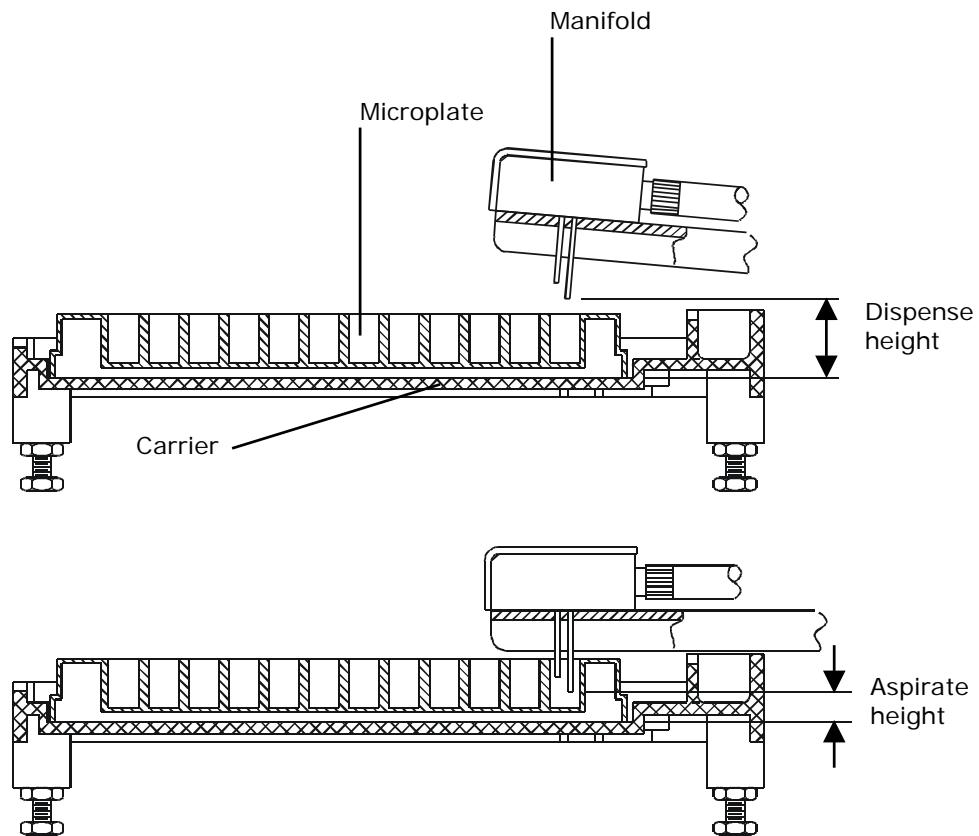


Figure 31: Dispense and Aspirate Heights for the 8-, 8s-, and 12-Channel Manifolds
(See **Figure 1** for an illustration of the 16-channel manifold)

Note: The dispense tubes are shorter than the aspirate tubes.

Edit Wash Program

To change a Wash program, follow the menu path shown here. Some of these items are options and some are prompts.

```
DEFINE → EDIT → WASH → SELECT WASH PROGRAM →
Edit the Program Component (Method, Dispense,
Aspiration) → MAIN MENU KEY → OK TO SAVE
PROGRAM?
```

Copy Wash Program

To copy a Wash program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → COPY → WASH → SELECT WASH PROGRAM →
NAME → OK TO COPY?
```

Copy Wash Program Options

Options	Actions
Select Wash Program	Select the Wash program you wish to copy.
Name	Enter a unique name for the new Wash program.
OK to Copy?	Select YES to copy the program.

Delete Wash Program

To delete a Wash program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → DELETE → WASH → SELECT WASH PROGRAM
→ OK TO DELETE?
```

Delete Wash Program Options

Options	Actions
Select Wash Program	Select the Wash program you wish to delete.
OK to Delete?	Select YES to delete the program.

Prime

This section discusses how to define, run, edit, copy, and delete Prime programs.

Define Prime Program

To define a Prime program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → CREATE → PRIME → NAME → PRIME
VOLUME → PRIME FLOW RATE → SOAK AFTER PRIME?
→ SOAK DURATION → OK TO SAVE PROGRAM?
```

Define Prime Program Options

Options	Actions
Name	Type a unique name for the Prime program. See Entering Program Names on page 54 for instructions.
Prime Volume	Specify the volume of the buffer or rinse used to prime the dispense tubes. The volume range is 1 to 200 ml.
Prime Flow Rate	Specify the rate at which the priming fluid is pumped into the dispense tubes. The flow rate options range from 1 to 9 (1 to 7 for the 12-channel manifold), where 1 = Slowest, 9 = Fastest. The washer display shows the corresponding $\mu\text{l}/\text{well}/\text{sec}$ value for each option.
Soak after Prime?	Select YES to soak the manifold tubes after they have been primed. After the dispense tubes have been primed, the manifold raises to a trough clearance height and the carrier returns to its "home" position so that the dispense and aspirate tubes sit above the carrier trough. The soak solution is then dispensed to the trough. The vacuum pump is turned off and the tubes are lowered into the trough to soak. After the specified Soak Duration (see below), the vacuum pump is turned on and the trough aspirated.
Soak Duration	Soak Duration represents the time to allow the dispense and aspirate tubes to be soaked in wash buffer, rinse, or disinfectant. The range is from 1 minute to 18 hours.
OK to Save Program?	Select YES to save the program.

PRIME Program Defaults and Ranges

Parameter	Default	Range	Units
Prime Dispense Volume	40	1-200	milliliters
Prime Flow Rate	5	1-9 (1-7 for 12-channel)*	µl/well/sec
Soak After Prime	No	Yes/No	
Soak Duration	1 minute	1 minute to 18 hours	minutes to hours

*Prime Flow Rate (µl/well/sec):

	8/8s	12	16
1 =	150	150	225
2 =	200	200	250
3 =	300	300	300
4 =	450	450	325
5 =	500	500	350
6 =	600	600	375
7 =	650	650	400
8 =	800	-----	450
9 =	1000	-----	500

Run Prime Program

To run a Prime program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
RUN → PRIME → SELECT PRIME PROGRAM → SELECT
REAGENT BOTTLE* → CONNECT REAGENT BOTTLE AND
PRESS <START> KEY → PRIME PROGRAM RUNNING.
PRESS <STOP> KEY TO QUIT → PRIME PROGRAM
COMPLETE. PRESS <ENTER> KEY
```

* SELECT REAGENT BOTTLE only appears on the "V" version washers.

Run Prime Program Options

Options	Actions
Prime Program	Select a Prime program. Special note for washers with dual-configuration for switching between the 16- and 8-channel manifolds: Only those programs defined under the current configuration will be presented for selection. For example, if you are currently using the 16-channel manifold, only those programs that were defined with the 16-channel configuration will be shown to you.
Select Reagent Bottle	Select the reagent bottle from which to dispense. This applies only to "V" version models.

Edit Prime Program

To change a Prime program, follow the menu path shown here. Some of these items are options and some are prompts.

```
DEFINE → EDIT → PRIME → SELECT PRIME PROGRAM
→ Edit the Program Parameters → MAIN MENU KEY
→ OK TO SAVE PROGRAM?
```

Copy Prime Program

To copy a Prime program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → COPY → PRIME → SELECT PRIME PROGRAM
→ NAME → OK TO COPY?
```

Copy Prime Program Options

Options	Actions
Select Prime Program	Select the Prime program you wish to copy.
Name	Enter a unique name for the new Prime program.
OK to Copy?	Select YES to copy the program.

Delete Prime Program

To delete a Prime program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → DELETE → PRIME → SELECT PRIME
PROGRAM → OK TO DELETE?
```

Delete Prime Program Options

Options	Actions
Select Prime Program	Select the Prime program you wish to delete.
OK to Delete?	Select YES to delete the program.

Dispense

This section discusses how to define, run, edit, copy, and delete Dispense programs.

Define Dispense Program

To define a Dispense program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → CREATE → DISP → NAME → PLATE TYPE*  
→ DISPENSE VOLUME → DISPENSE FLOW RATE →  
DISPENSE HEIGHT → HORIZONTAL DISP POS → PRIME  
BEFORE START? → PRIME VOLUME → PRIME FLOW RATE  
→ OK TO SAVE PROGRAM?
```

* PLATE TYPE only appears if the washer is configured with the 16-channel manifold.

Define Dispense Program Options

See **Define Wash DISPENSE Program Options** on page 64 for a complete list of dispense program options. Note that the shaded options are not available for Dispense-only programs.

Run Dispense Program

To run a Dispense program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
RUN → DISP → SELECT DISP PROGRAM → SELECT  
REAGENT BOTTLE* → PRIME THE WASHER? → SELECT  
PRIME PROGRAM → FIRST STRIP → NUMBER OF STRIPS  
→ PLACE PLATE IN CARRIER AND PRESS <START> KEY  
→ DISPENSE PROGRAM RUNNING. PRESS <STOP> KEY  
TO QUIT → DISP PROGRAM COMPLETE. PRESS  
<ENTER> KEY
```

* SELECT REAGENT BOTTLE appears only on the "V" version washers.

Run Dispense Program Options

Options	Actions
Disp Program	Select a Dispense program. Special note for washers with dual-configuration for switching between the 16- and 8-channel manifolds: Only those programs defined under the current configuration will be presented for selection. For example, if you are currently using the 16-channel manifold, only those programs that were defined with the 16-channel configuration will be shown to you.
Reagent	Select which reagent bottle from which to dispense. This applies only to the "V" version models.
First Strip	Specify the number of the first strip to be washed.
Number of Strips	Specify the number of microwell strips to be washed (the actual selectable range is based on the First Strip value): 1 to 12 for the 8- or 8s-channel manifold 1 to 8 for the 12-channel manifold 1 to 24 for the 16-channel manifold

Edit Dispense Program

To change a Dispense program, follow the menu path shown here. Some of these items are options and some are prompts.

```
DEFINE → EDIT → DISP → SELECT DISP PROGRAM →
Edit the Program parameters → MAIN MENU KEY →
OK TO SAVE PROGRAM?
```

Copy Dispense Program

To copy a Dispense program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → COPY → DISPENSE → SELECT DISP
PROGRAM → NAME → OK TO COPY?
```

Copy Dispense Program Options

Options	Actions
Select Dispense Program	Select the Dispense program you wish to copy.
Name	Enter a unique name for the new Dispense program.
OK to Copy?	Select YES to copy the program.

Delete Dispense Program

To delete a Dispense program, follow the washer menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → DELETE → DISP → SELECT DISP PROGRAM  
→ OK TO DELETE?
```

Delete Dispense Program Options

Options	Actions
Select Dispense Program	Select the Dispense program you wish to delete.
OK to Delete?	Select YES to delete the program.

Aspiration



Important! The **ELx50™/8FMW** uses either the manifold (with the microplate carrier) for top aspiration of solid-bottom plates, or the aspiration carrier for bottom aspiration of filter-bottom plates. ASPIRATE TYPE and BOT ASPIRATE TIME only appear if the washer model is the ELx50/8FMW, and the manifold is configured as either 8- or 8s-channel. Because the heights of the microplate and aspiration carriers are different, it is important that you use the correct carrier for the ASPIRATE TYPE:

- For a TOP ASPIRATE, use the microplate carrier.
- For a BOT ASPIRATE, use the aspiration carrier.

This section discusses how to define, run, edit, copy, and delete Aspiration programs.

Define Aspiration Program

To define an Aspiration program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → CREATE → MORE → ASPIR → NAME → PLATE
TYPE* → ASPIRATE TYPE** → BOT ASPIRATE TIME**
→ ASPIRATE HEIGHT → HORIZONTAL ASPR POS →
ASPIRATION RATE → ASPIRATE DELAY → CROSSWISE
ASPIR? → CROSSWISE HEIGHT → CROSSWISE HORIZ POS
→ OK TO SAVE PROGRAM?
```

* PLATE TYPE only appears if the washer is configured with the 16-channel manifold.

** ASPIRATE TYPE and BOT ASPIRATE TIME only appear if the washer is an ELx50/8FMW and the manifold is configured as either 8- or 8s-channel.

Define Aspiration Program Options

See **Define Wash ASPIRATION Program Options** on page 67 for a complete listing of Aspiration Program Options that are available for Wash programs and Aspirate-only programs. Note that the shaded options are not available for Aspirate-only programs.

The tables on the following page list options and parameters that are only available for Aspirate-only programs.

Define Aspirate-only Program Options

Options	Actions
Aspirate Type	Aspirate Type identifies whether the manifold (with the microplate carrier) or the aspiration carrier is to be used for the aspirate function of an Aspirate-only program. This is only available for ELx50/8FMW models, and the manifold must be either 8- or 8s-channel. The two options are TOP for top aspiration using the manifold with the microplate carrier, and BOT for bottom aspiration using the aspiration carrier. The default is TOP.
BOT Aspirate Time	The bottom aspirate time indicates how long to aspirate fluid using the aspiration carrier. The bottom aspirate time option ranges from 1 to 180 seconds. The default value is 30 seconds.

Aspirate-only Program Defaults and Ranges

Parameter	Default	Range	Units
Aspirate Type	TOP	TOP/BOT	
BOT Aspirate Time	30	1-180	seconds

Run Aspiration Program

To run an Aspiration program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
RUN → MORE → ASPIR → SELECT ASPIR PROGRAM →
FIRST STRIP* → NUMBER OF STRIPS* → PLACE PLATE
IN CARRIER AND PRESS <START> KEY → ASPIR
PROGRAM RUNNING. PRESS <STOP> KEY TO QUIT →
ASPIR PROGRAM COMPLETE. PRESS <ENTER> KEY
```

* FIRST STRIP and NUMBER OF STRIPS will not be displayed for Aspirate programs containing a bottom aspirate.

Run Aspiration Program Options

Options	Actions
Aspir Program	Select an Aspiration program. Special note for washers with dual-configuration for switching between the 16- and 8-channel manifolds: Only those programs defined under the current configuration will be presented for selection. For example, if you are currently using the 16-channel manifold, only those programs that were defined with the 16-channel configuration will be shown to you.
First Strip	Specify the number of the first strip to be washed.
Number of Strips	Specify the number of microwell strips to be washed (the actual selectable range is based on the First Strip value): 1 to 12 for the 8- or 8s-channel manifold 1 to 8 for the 12-channel manifold 1 to 24 for the 16-channel manifold

Edit Aspiration Program

To change an Aspiration program, follow the menu path shown here. Some of these items are options and some are prompts.

```
DEFINE → EDIT → MORE → ASPIR → SELECT ASPIR
PROGRAM → Edit Program parameters → MAIN MENU
KEY → OK TO SAVE PROGRAM?
```

Copy Aspiration Program

To copy an Aspiration program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → COPY → MORE → ASPIR → SELECT ASPIR
PROGRAM → NAME → OK TO COPY?
```

Copy Aspiration Program Options

Options	Actions
Select Aspiration Program	Select the Aspiration program you wish to copy.
Name	Enter a unique name for the new Aspiration program.
OK to Copy?	Select YES to copy the program.

Delete Aspiration Program

To delete an Aspiration program, follow the washer menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → DELETE → MORE → ASPIR → SELECT
ASPIR PROGRAM → OK TO DELETE?
```

Delete Aspiration Program Options

Options	Actions
Select Aspiration Program	Select the Aspiration program you wish to delete.
OK to Delete?	Select YES to delete the program.

Soak

This section discusses how to define, edit, copy, and delete Soak programs.

- A soak begins after the wash buffer is dispensed to the wells. In some chemistries it enhances washing by allowing unbound material to diffuse into the wash buffer.
- A Soak program cannot be run on its own; it must be selected as part of a Link program (see page 86).
- Soak program parameters can also be defined within a Wash program (see page 62).
- Washer basecode PN 4070201 does not support Soak programs. See **Software Variations** in **Chapter 1** for more information.

Define Soak Program

To define a Soak program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → CREATE → MORE → SOAK → NAME → SOAK
DURATION → SHAKE BEFORE SOAK? → SHAKE DURATION
→ SHAKE INTENSITY → OK TO SAVE PROGRAM?
```

Define Soak Program Options

Options	Actions
Name	Enter the name of the Soak program. See Entering Program Names on page 54 for instructions.
Soak Duration	Soak Duration represents the time to allow the wash buffer to remain in the wells before aspiration. The duration range is from 0 to 600 seconds. Note: When washing strips in a plate format use a soak that lasts as long as it takes to process one wash cycle of all strips.
Shake Before Soak?	Choose YES to agitate the microwells back and forth linearly along the carrier track to aid in dispersal. Before the microwells begin shaking, the manifold raises so that the dispense and aspirate tubes clear the microwells. The carrier returns to its home position so that the tubes are above the carrier trough.
Shake Duration	Shake Duration represents the length of time that the microwells are agitated. The duration range is from 1 to 600 seconds.

Options	Actions
Shake Intensity	Specify the intensity of microwell shaking. The options range from 1 to 5, where 1 = Least Intense, 5 = Most Intense. The washer display shows the corresponding cycles/sec value for each option.
OK to save program?	Select YES to save the program.

Edit Soak Program

To change a Soak program, follow the menu path shown here. Some of these items are options and some are prompts.

```
DEFINE → EDIT → MORE → SOAK → SELECT SOAK
PROGRAM → "Edit the soak parameters" → OK TO
SAVE PROGRAM?
```

Copy Soak Program

To copy a Soak program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → COPY → MORE → SOAK → SELECT SOAK
PROGRAM → NAME → OK TO COPY?
```

Copy Soak Program Options

Options	Actions
Select Soak Program	Select the Soak program you wish to copy.
Name	Type a unique name for the new Soak program.
OK to Copy?	Select YES to copy the program.

Delete Soak Program

To delete a Soak program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → DELETE → MORE → SOAK → SELECT SOAK
PROGRAM → OK TO DELETE?
```

Delete Soak Program Options

Options	Actions
Select Soak Program	Select the Soak program you wish to delete.
OK to Delete?	Select YES to delete the program.

Linking Programs

This section discusses how to define, view, run, and delete Link programs.

- Pre-defined Wash, Prime, Aspirate, Dispense, and/or Soak programs can be “linked” together and run sequentially and automatically.
- A Link program can contain up to 10 programs, all of which must specify the same plate type (96 or 384).
- For “V” version washers, all of the linked programs must use fluid from the same supply bottle. The supply bottle location (A, B, or C) is specified at program run time.
- Once defined, a Link program can be viewed, run, or deleted. It cannot be edited or copied.
- Washer basecode PN 4070201 does not support Link programs. See **Software Variations** in **Chapter 1** for more information.

Define Link Program

To define a Link program, follow the washer menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → CREATE → MORE → LINK → NAME → PLATE
TYPE* → SELECT LINK 01 (02, 03, up to 10)
TYPE: → OK TO SAVE PROGRAM?
```

* PLATE TYPE only appears if the washer is configured with the 16-channel manifold.

Define Link Program Options

Options	Actions
Name	Enter a unique name for the Link program. See Entering Program Names on page 54 for instructions.
Plate Type	Select a Plate Type of 96 to link programs defined for 8-well strips or 96-well plates, or 384 to link programs defined for 384-well plates.
Select Link (n) Type	Select each Wash, Prime, Dispense, Aspirate, and/or Soak program to be included in the Link program. Programs will run in the order in which they are selected. Note: If the Plate Type option appeared (see above), only programs with the selected Plate Type will be accessible for inclusion in the Link program.

Options	Actions
Press Main Menu to end	Select YES to save the program.

❖ **Troubleshooting Tip:** If your washer has basecode software part number 4070230 with custom programs created before June 1999 and you are unable to create Link programs, try this: for each program you wish to include in a Link program, select DEFINE > EDIT > choose the program > press Main Menu > choose YES to save the program. If this does not solve the problem, please contact BioTek TAC.

View Link Program

A Link program cannot be edited, but its contents can be viewed. To view a Link program, follow the menu path shown below.

```
DEFINE → EDIT → MORE → LINK → SELECT LINK
PROGRAM → PLATE TYPE → VIEW LINK 01 (02, 03,
up to 10) → MAIN MENU KEY
```

Run Link Program

To run a Link program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
RUN → MORE → LINK → SELECT LINK PROGRAM →
SELECT REAGENT BOTTLE* → PRIME THE WASHER? →
FIRST STRIP** → NUMBER OF STRIPS** → PLACE
PLATE IN CARRIER AND PRESS <START> KEY → LINK
PROGRAM RUNNING. PRESS <STOP> KEY TO QUIT →
LINK PROGRAM COMPLETE. PRESS <ENTER> KEY
```

* SELECT REAGENT BOTTLE appears only on the "V" version washers.

** If a Link program contains an Aspirate program that uses the aspiration carrier (ELx50™/8FMW model), the FIRST STRIP and NUMBER OF STRIPS prompts do not apply to that portion of the program, since the aspiration carrier works with 96-well filter-bottom full plates only.

Run Link Program Options

Options	Actions
Link Program	Select a Link program. Only those programs defined under the current configuration will be presented for selection. For example, if you are currently using the 16-channel manifold, only those programs that were defined with the 16-channel configuration will be shown to you.
Reagent	Select the supply bottle for use with all of the linked programs. This applies only to "V" version models.
Prime?	Run a prime program before starting the first linked program.
First Strip	Specify the number of the first strip to be washed.
Number of Strips	Specify the number of microwell strips to be washed (the actual selectable range is based on the First Strip value): 1 to 12 for the 8- or 8s-channel manifold 1 to 8 for the 12-channel manifold 1 to 24 for the 16-channel manifold

Delete Link Program

To delete a Link program, follow the menu path shown here. Some of these items are options and some are prompts. The options are described below.

```
DEFINE → DELETE → MORE → LINK → SELECT LINK
PROGRAM → OK TO DELETE?
```

Delete Link Program Options

Options	Actions
Select Link Program	Select the Link program you wish to delete.
OK to Delete?	Select YES to delete the program.

Utility

The Utility (**UTIL**) menu options include **TESTS**, **SETUP**, and **AUTOPRIME**. These options are described below and on the following pages.

Tests

The system Self-Test (**SLFCHK**) and Checksum Test (**CHKSUM**) are performed automatically whenever the ELx50™ is turned on. The Tests option enables you to manually run both of these tests.

Self-Test (SLFCHK)

The Self-Test verifies system components, such as vacuum, manifold, and manifold to carrier positioning. To run the Self-Test, follow the menu path below:

UTIL → TESTS → SLFCHK

If the test completes successfully, the washer is ready for use. If the test fails, the washer will “chirp” and display an error code. Press **STOP** to stop the chirp, then look up the code in **Appendix A, Error Codes**.

Configuration Information (CHKSUM)

The Checksum Test verifies on-board software with internally recorded checksum values. To run the Checksum Test, follow the menu path below:

UTIL → TESTS → CHKSUM

The initial checksum test displays the on-board (basecode) software part number, version, and checksum:

4070xxx Verx.xx
CODE CHECKSUM: (DDA7)

After a few moments, the second checksum test displays the customer configuration software part number and version:

4070xxx-FW vx.xx.x

Setup

Manifold (MANIFLD)

Your ELx50™ Microplate Strip Washer was initially configured for and shipped with an 8-, 12-, 8s-, or 16-channel wash manifold. It is important that the washer software configuration accurately represent the manifold installed in the instrument. If you change the hardware, you must also change the software configuration. See **Appendix B, ELx50 Manifold Variations** for more information.

To view or change the configuration of the manifold to 8-, 12-, 8s-, or 16-channel, follow the washer menu path shown below:

```
UTIL → SETUP → MANIFLD → SELECT MANIFOLD:
8      12*     8S      16**
```

* For washers with the aspiration carrier (ELx50/8FMW model), if 12 is selected for the manifold, aspiration using the aspiration carrier is not available.

**16 will not be displayed on ELx50/8FMW washers.

SENSOR

ELx50 washers manufactured after October 2007 support the **Liquid Level Alert**™ option. With this option, each bottle has a level sensing device inside. When a supply bottle's fluid level drops to approximately 400-450 mL, or the waste bottle's fluid level rises to approximately 1400-1450 mL, a sensor will activate. See page 59 for more information.

Sensor detection is *enabled* on the washer by default. You can disable it, but you will be responsible for observing the fluid levels in the bottles. To view or change the sensor detection setting, follow the washer menu path below:

```
UTIL → SETUP → SENSOR → LIQUID LEVEL ALERT?
YES      NO
```

AutoPrime

The AutoPrime option is important for preventive maintenance of the ELx50™. Frequent priming keeps the washer manifold tubes moist and helps to prevent them from clogging. See **Chapter 4, Maintenance and Performance Verification (IQ/OQ/PQ)** for more information on the AutoPrime feature.

The AutoPrime option may be enabled, disabled, or edited. If enabled, the program will run automatically after the washer is idle for the specified period of time. To enable or disable the AutoPrime feature, follow the menu paths shown below:

Enable:

```
UTIL ➔ AUTOPRIME ➔ ENABLE AUTOPRIME? ➔ YES
```

Disable:

```
UTIL ➔ AUTOPRIME ➔ ENABLE AUTOPRIME? ➔ NO
```

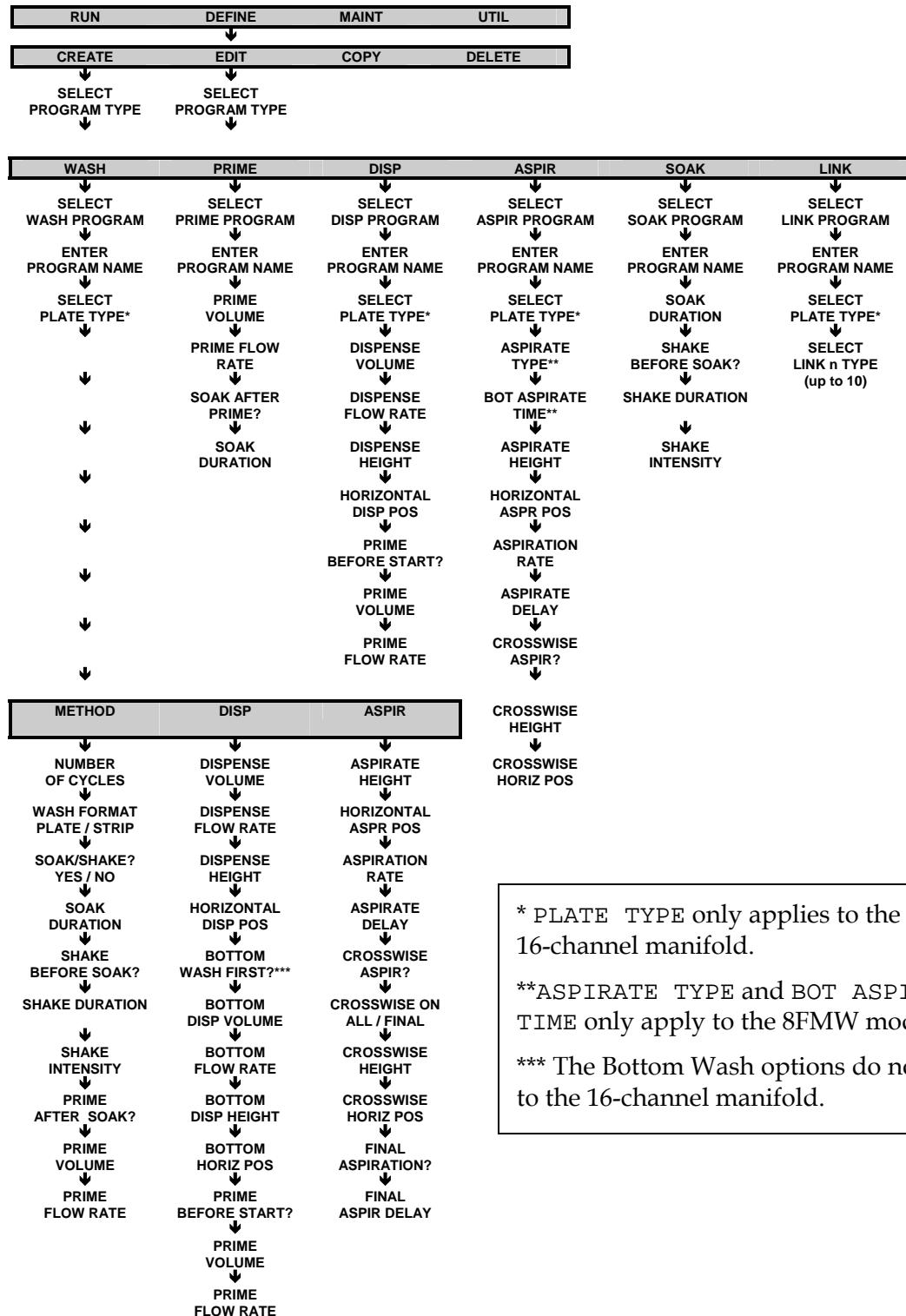
To interrupt the AutoPrime feature, press the **STOP** key.

To edit the AutoPrime program, follow the washer menu path shown below.

```
DEFINE ➔ EDIT ➔ PRIME ➔ SELECT PRIME PROGRAM  
➔ Edit the Program Parameters ➔ OK TO SAVE  
PROGRAM?
```

ELx50™ Microplate Strip Washer Menu Maps

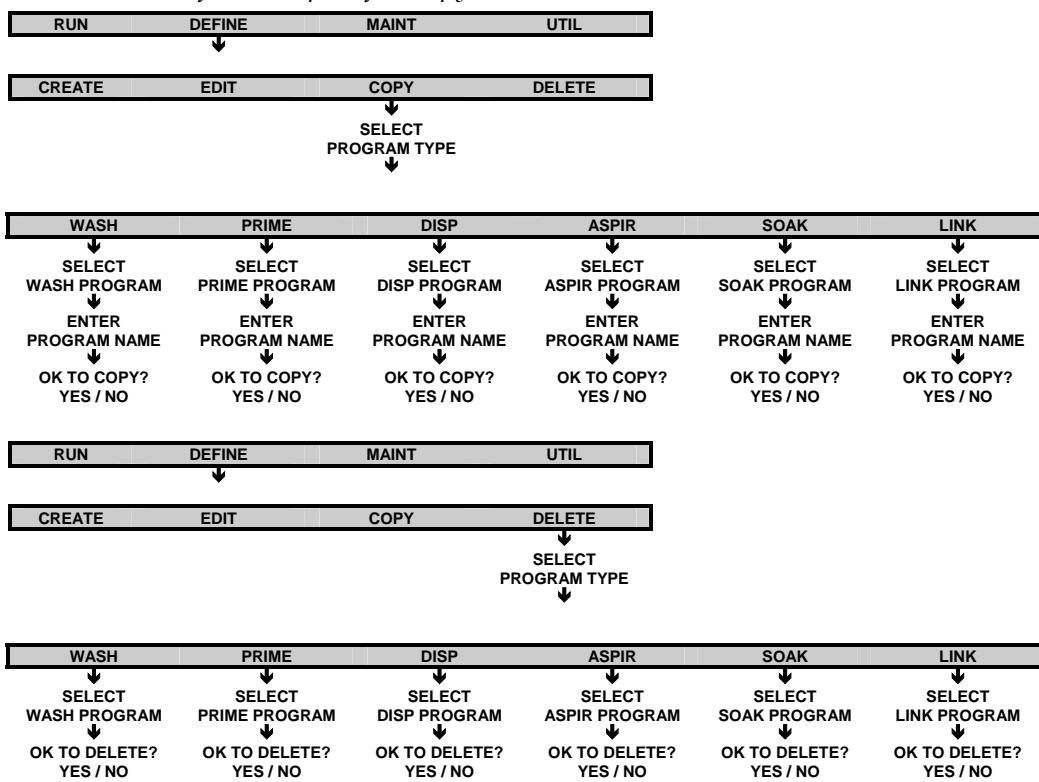
Main Menu (DEFINE function path for Create and Edit)



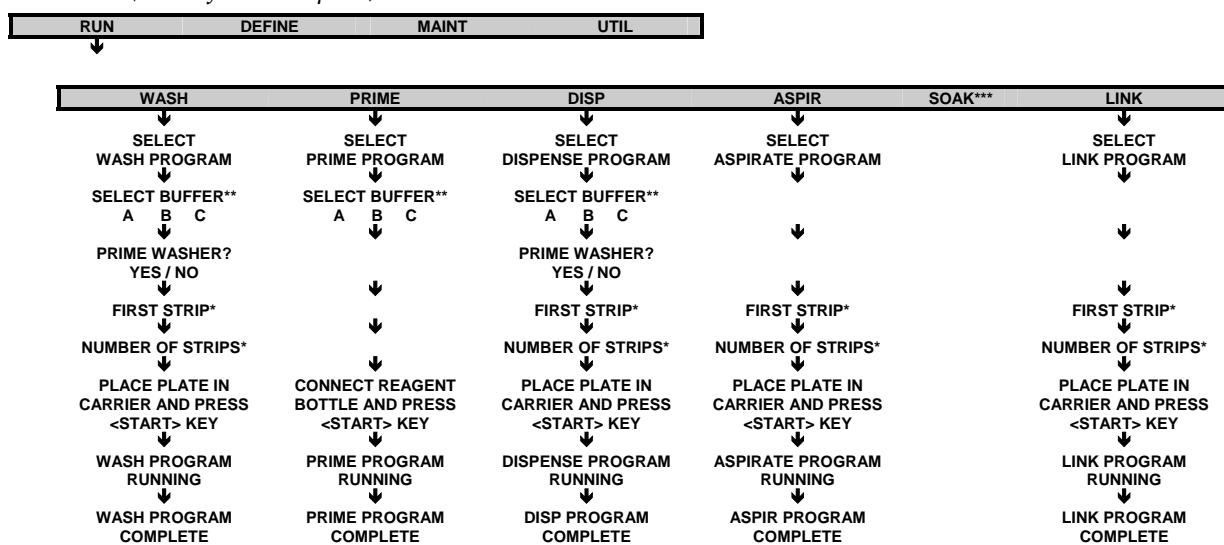
* PLATE TYPE only applies to the 16-channel manifold.

**ASPIRATE TYPE and BOT ASPIRATE TIME only apply to the 8FMW model.

*** The Bottom Wash options do not apply to the 16-channel manifold.

Main Menu (DEFINE function path for Copy and Delete)

Main Menu (RUN function path)

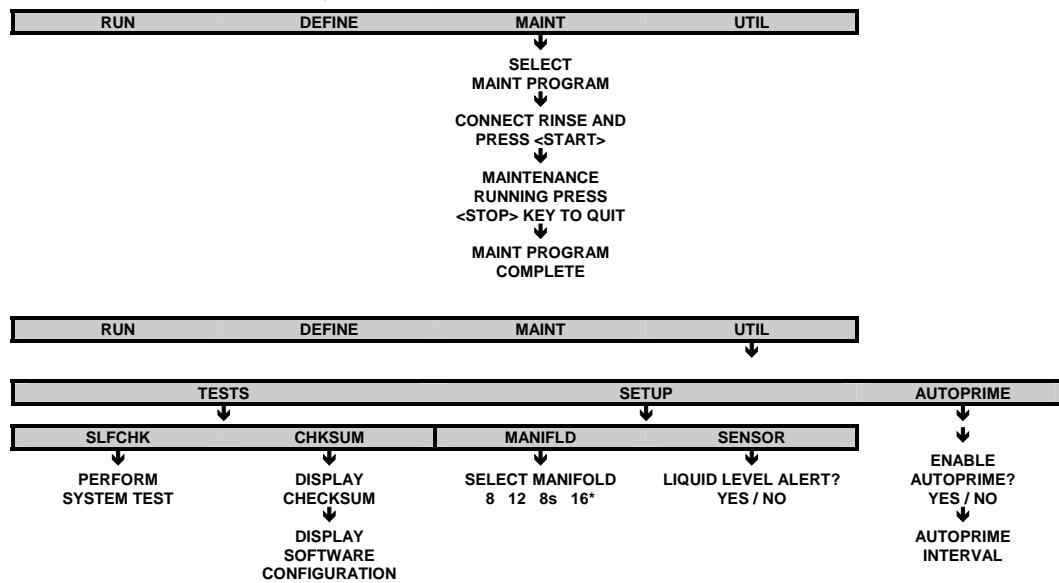


If the Enter key is pressed at the WASH, PRIME, DISPENSE, ASPIRATE, or LINK PROGRAM COMPLETE screen, then the user is returned to the corresponding SELECT PROGRAM screen. For example, after a Wash program completes, pressing ENTER returns the user to the SELECT WASH PROGRAM screen.

* FIRST STRIP and NUMBER OF STRIPS are not displayed for Aspirate programs using the aspiration carrier (ELx50/8FMW model).

** The SELECT BUFFER option only appears for ELx50™ washers equipped with the multiple valves hardware.

*** A Soak program cannot be run independently; it must be selected within a Link program. Soak parameters can be defined within a Wash program (see "Main Menu, DEFINE function path for Create and Edit").

Main Menu (MAINT, UTIL function path)

* "16" is not displayed on ELx50/8FMW washers.

Chapter 4

Maintenance and Performance Verification (IQ/OQ/PQ)

This chapter describes how to maintain, store, decontaminate, and verify performance of the ELx50™.

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Overview

Preventive Maintenance (PM), Installation Qualification (IQ), Operational Qualification (OQ), and Performance Qualification (PQ) represent a set of procedures that should be performed regularly to maintain equipment in top condition and confirm its operation to specification. For example, during normal operation, salt crystals can build up and clog the valves and tubes. Adherence to the **Recommended Maintenance** and **Performance Verification Schedules** on the following pages will reduce this problem, maximize running time, and extend the life of the washer.

The **Maintenance** section of this chapter (starting on p. 102) includes instructions for the following:

- Daily, Overnight, and Monthly Maintenance
- Long-Term Storage Maintenance
- Decontamination

The **Performance Verification (IQ/OQ/PQ)** section of this chapter (starting on p. 122) includes:

- System and Checksum Tests
- Liquid Testing
- Evacuation Efficiency Tests and
- Dispense Precision tests

Maintenance/Performance and Operational Qualification logs are provided at the end of this chapter.

Recommended Maintenance and Performance Verification Schedules

The schedules on the following pages recommends preventive maintenance and performance verification tasks, the frequency with which each task should be performed, the pre-defined onboard program that should be run, and where to find more information.

❖ It is important to note that the risk and performance factors associated with your assays may require that some or all of the procedures be performed more frequently than presented in the schedule.

Recommended Maintenance Schedule

TASK	Frequency		Long-Term Storage
	Daily	Monthly	
Protein-residual removal, p. 102	✓		
Daily maintenance program: p. 104 DAY_RINSE	✓		
AutoPrime, p. 104	✓		
Overnight maintenance program: p. 106 OVERNIGHT_LOOP	✓		
Periodic rinse and soak program: p. 107 RINSE_AND_SOAK	✓		
Clean bottles, p. 109		✓	✓
Check/empty waste bottle, p. 109	✓		✓
Clean manifold p. 109		✓	✓
Clean mist shield, p. 109		✓	
Clean aspirate and dispense tubes, p. 110		✓	✓
Clean microplate carrier and aspiration carrier (ELx50™/8FMW), p. 111 and p. 112		✓	✓
Clean tubing check valves, p. 114		✓	✓
Remove liquid from washer parts program: p. 115 LONG_SHUTDOWN			✓
Decontaminate program: p. 117 DECONTAMINATION		✓	✓

Recommended Performance Verification Schedule

TASK	Installation Qualification	Operational Qualification	Performance Qualification
		<i>Initially & Annually</i>	<i>Monthly</i>
System Self-Test, p. 125	✓	✓	✓
Checksum Test, p. 125	✓	✓	✓
8-, 8s- 12-Channel Manifolds:			
Evacuation Efficiency Test, p. 127		✓	✓
Dispense Precision Test, p. 128		✓	✓
16-Channel Manifold:			
Evacuation Efficiency Test, p. 131		✓	✓
Dispense Precision Test, p. 132		✓	✓
Aspiration Carrier (ELx50/8FMW):			
Evacuation Efficiency Test, p. 134		✓	✓

Warnings & Precautions

Please read the following before performing any Maintenance procedures:

	<p>Warning! Internal Voltage. Turn off and unplug the instrument for all maintenance operations.</p>
	<p>Warning! Wear protective gloves when handling contaminated instruments. Gloved hands should be considered contaminated at all times; keep gloved hands away from eyes, mouth, nose, and ears.</p>
	<p>Warning! Mucous membranes are considered prime entry routes for infectious agents. Wear eye protection and a surgical mask when there is a possibility of aerosol contamination. Intact skin is generally considered an effective barrier against infectious organisms; however, small abrasions and cuts may not always be visible. Wear protective gloves when handling contaminated instruments.</p>
	<p>Caution: Chemical Compatibility with Washers. Some chemicals may cause irreparable damage to washers. The following chemicals have been deemed safe for use in washers: buffer solutions (such as PBS), saline, surfactants, deionized water, 70% ethyl, isopropyl, or methyl alcohol, 40% formaldehyde, and 20% sodium hydroxide. Never use acetic acid, DMSO, or organic solvents. Other chemicals may cause severe damage to the instrument. Contact BioTek prior to using any other chemicals. Refer to Appendix C, Chemical Compatibility.</p>
	<p>Caution: Sodium Hypochlorite. Do not expose any part of the instrument to the recommended diluted sodium hypochlorite solution (bleach) for more than 20 minutes. Prolonged contact may damage the instrument surfaces. Be certain to rinse and thoroughly wipe all surfaces.</p>
	<p>Important! Do not immerse the instrument, spray it with liquid, or use a "wet" cloth on it. Do not allow water or other cleaning solution to run into the interior of the instrument. If this happens, contact BioTek's Technical Assistance Center.</p>

Maintenance Programs

The ELx50™ onboard software contains pre-defined maintenance programs, including `DAY_RINSE`, `RINSE_AND_SOAK`, `OVERNIGHT_LOOP`, `DECONTAMINATION`, and `LONG_SHUTDOWN`. These programs are accessible from the washer main menu, under the `MAINT` option.

To run a maintenance program:

1. From the Main Menu, select `MAINT`.
2. Select the desired maintenance program.
3. Press the **START** key to begin. To halt the maintenance program in progress, press **STOP**.
4. When the program is complete, press **ENTER** to return to the Main Menu.



Important! Solutions containing proteins, such as bovine serum albumin (BSA), will compromise the washer's performance over time unless a strict maintenance protocol is adhered to. It is recommended that a daily rinse and overnight soaking with phosphate buffered saline (PBS) be conducted. Rinse well with deionized water to remove the PBS in the morning. On a weekly or monthly basis, flush with 0.1-0.5N NaOH, followed by neutralization with an equivalent normality (0.1-0.5N) of HCl. Rinse well with deionized water to remove the HCl.



Important! Keep the manifold in a wetted condition to ensure proper evacuation of fluid. BioTek recommends changing the Soak Duration to 18 hours for overnights and weekends when the washer is not being used. This will decrease flow problems and is a more trouble-free way to operate the washer.

Prime Programs

Each pre-defined maintenance program runs a pre-defined prime program. The charts below show the *default* prime program parameters. These parameters can be modified.

To view or edit the parameters for a particular prime program (and thus, the associated Maintenance program):

1. From the Main Menu, follow the path below:

DEFINE → EDIT → PRIME → Select the program

2. Press the **Enter** key to cycle through the parameters.

Maintenance Program:	DAY_RINSE
Prime Program:	P_DAY_RINSE
Prime Volume:	60 mL
Flow Rate:	6
Soak After Prime?	No

Maintenance Program:	RINSE_AND_SOAK
Prime Program:	P_RINSE_AND_SOAK
Prime Volume:	60 mL
Flow Rate:	6
Soak After Prime?	Yes
Soak Duration:	5 minutes*

Maintenance Program:	OVERNIGHT_LOOP
Prime Program:	P_RINSE_LOOP
Prime Volume:	40 mL
Flow Rate:	6
Soak After Prime?	Yes
Soak Duration:	4 hours

Daily Maintenance

For all daily maintenance programs, ensure that the supply bottle contains at least 200 mL of rinse solution, and that the waste bottle is empty.

DAY_RINSE

Daily maintenance involves flushing the washer with an appropriate reagent at the beginning of the day (BioTek recommends using a buffer solution in the morning). The DAY_RINSE program is recommended for the morning. This should be done *on the same day the microplates are washed*. This procedure helps prevent the aspirate and dispense tubes from clogging between washes.

AUTOPRIME

Frequent priming keeps the washer manifold tubes moist and helps to prevent them from clogging. BioTek recommends using the AUTOPRIME feature. AUTOPRIME is particularly useful if the washer is used intermittently throughout the day. Once the feature is activated, the *AutoPrime prime program* runs automatically at specified intervals until the feature is deactivated. If you prefer not to have the AutoPrime feature on, it would be necessary to run the DAY_RINSE program periodically during the day.

To enable or disable the AutoPrime feature, from the Main Menu follow the paths shown below.

Enable:

```
UTIL → AUTOPRIME → ENABLE AUTOPRIME? → YES
```

Disable:

```
UTIL → AUTOPRIME → ENABLE AUTOPRIME? → NO
```

The AutoPrime program can be edited to change the length of the soak period, eliminate the soak period, or to change the interval between AutoPrime cycles.

To view or edit the AutoPrime program, follow the path below:

```
DEFINE → EDIT → PRIME → SELECT PRIME PROGRAM  
→ Edit the Program Parameters → OK TO SAVE  
PROGRAM?
```

AutoPrime Program Options, and a Defaults and Ranges table are on the following page.

AutoPrime Program Options

Options	Actions
Prime Volume	Specify the volume of the buffer or rinse used to prime the manifold. The volume range is 1 to 200 mL. Do not specify more volume than can be safely contained in the waste bottle during idle periods.
Prime Flow Rate	Specify the rate at which the priming fluid is pumped into the dispense tubes. The flow rate options range from 1 to 9, where 1 = Slowest, 9 = Fastest. The washer display shows the corresponding μ l/well/sec value for each option.
Soak after Prime?	Select YES to soak the manifold tubes after they have been primed. After the dispense tubes have been primed, the manifold raises to a trough clearance height and the carrier returns to its "home" position so that the dispense and aspirate tubes are above the carrier trough. The soak solution is then dispensed to the trough. The vacuum pump is turned off and the tubes are lowered into the trough to soak. After soaking, the vacuum pump is turned on and the trough aspirated.
Soak Duration	Soak Duration represents the time to allow the dispense and aspirate tubes to be soaked in wash buffer, rinse, or disinfectant. The range is from 1 minute to 18 hours.

❖ **Note:** By connecting a rinse bottle to the washer, the AutoPrime feature can be used to automatically rinse the washer.

Parameter	Default	Selectable Range
Interval	10 minutes	10 to 600 minutes
Prime Volume	60 mL	1 to 200 mL
Prime Flow Rate	6	1 to 9, or 1 to 7 for 12-channel manifold
Soak After Prime?	Enabled	Enabled/Disabled
Soak Duration	3 hours, 50 minutes	1 minute to 18 hours

Overnight Maintenance

OVERNIGHT_LOOP

When left overnight or for the weekend, the OVERNIGHT_LOOP program is recommended. Overnight/multi-day maintenance involves flushing all wash solution out of the instrument, then periodically rinsing and soaking the tubes to keep them moist.

1. Connect a supply bottle containing deionized water and run DAY_RINSE, to flush any wash solution out of the washer.
2. Run the OVERNIGHT_LOOP program to prime and soak the tubes. It is important to keep the manifold in a wetted condition to ensure proper evacuation of fluid. BioTek recommends changing the Soak Duration to 18 hours for overnights and weekends when the washer isn't being used. This will decrease flow problems and is a more trouble-free way to operate the washer.
3. The OVERNIGHT_LOOP does require that the washer be kept plugged in and turned on. As an alternative, run the RINSE_AND_SOAK maintenance program and turn off the instrument after the soak begins. This leaves the tubes soaking in the priming trough until the instrument is turned on again.
4. The OVERNIGHT_LOOP program will run continuously until the Stop key is pressed. After pressing the Stop key, choose **YES** to home all axes.

To run the OVERNIGHT_LOOP program, start at the Main Menu and follow the washer menu paths shown below:

Washers not equipped with automatic valve switching:

```
Select MAINT → Press the Option key until
OVERNIGHT_LOOP appears → CONNECT RINSE AND
PRESS <START> KEY → MAINTENANCE RUNNING PRESS
<STOP> TO QUIT.
```

Washers equipped with automatic valve switching:

```
Select MAINT → Press the Option key until
OVERNIGHT_LOOP appears → RINSE VALVE? A B C →
START MAINTENANCE? YES → MAINTENANCE RUNNING
PRESS <STOP> TO QUIT.
```

RINSE_AND_SOAK

The RINSE_AND_SOAK program rinses the wash manifold and leaves the tubes soaking in the trough for the duration of the soak.

To run the RINSE_AND_SOAK program, start at the Main Menu and follow the washer menu paths shown below.

Washers not equipped with automatic valve switching:

```
Select MAINT → Press the Option key until
RINSE_AND_SOAK appears → CONNECT RINSE AND
PRESS <START> KEY → MAINTENANCE RUNNING PRESS
<STOP> TO QUIT.
```

Washers equipped with automatic valve switching:

```
Select MAINT → Press the Option key until
RINSE_AND_SOAK appears → RINSE VALVE? A B C →
START MAINTENANCE? YES → MAINTENANCE RUNNING
PRESS <STOP> TO QUIT.
```

Monthly Maintenance

Tools and Supplies

- 70% isopropyl alcohol
- Deionized or distilled water
- Dish soap or other mild cleaner
- Stylus maintenance kit (contains 1 aspirate and 1 dispense) (PN 4070523)
- Phillips head screwdriver
- Lint-free disposable towels
- Soft-bristled brush
- Rubber stopper for waste bottle (PN 4072034)
- Spare vacuum inline filter (PN 48146)
- Spare vacuum pump muffler (PN 4073009) (washers shipped after January 2008)
- Spare check valves (2) (PN 68061)
- Spare manifold gasket (rubber seal) (PN 4072012)
- Spare gasket for aspiration carrier (rubber seal, ELx50™/8FMW) (PN 4072096)
- Spare vent plug o-rings for aspiration carrier (2 per plug, ELx50/8FMW) (PN 19497)

❖ Part numbers are subject to change over time. Please contact BioTek Customer Care if you have any questions.

	<p>Warning! Internal Voltage. Always turn off and disconnect the ELx50 from its power supply for all cleaning operations.</p>
	<p>Important! Do not immerse the instrument, spray it with liquid, or use a “wet” cloth. Do not allow the cleaning solution to run into the interior of the instrument. If this happens, contact the BioTek Service Department.</p> <p>Do not soak the keypad—this will cause damage. Moisten a clean cloth with deionized or distilled water and wipe the keypad. Dry immediately with a clean, dry cloth. Do not apply lubricants to manifold gasket, manifold channel end seals, fittings, tubing connections, or any surface that is part of the fluid path. The use of any lubricant on the fluid handling components will interfere with the aspirating and dispensing performance, and may cause irreparable damage to these components.</p>

Cleaning the Bottles

- Clean the supply and waste bottles with deionized water before the first use, before each refill, and if they have been idle for any length of time.
- Accumulated algae, fungi, or mold may require decontamination. Decontamination is described on page 117.
- Empty the waste bottle. Rinse the cover every time the wash or rinse bottles are filled. Periodic decontamination may be required. Do not allow the waste bottle to overfill!

Cleaning the Manifold

Regular rinsing helps to keep the manifold clean, the aspirate and dispense tubes clear, and it increases the life of the tubing.

If you suspect a particular problem is related to the manifold (for example, clogged tubes can result in poor or uneven aspiration or dispensing), you should perform a thorough cleaning of the manifold. When necessary, follow the **Decontamination** procedure on page 117 to disinfect the manifold and tubing.

To clean the manifold:

1. Run the system “dry”: connect an empty supply bottle, and prime the washer until the tubing is empty.
2. Turn off and unplug the washer.
3. Moisten a lint-free disposable towel with water, or with water and mild detergent. **Do not soak the cloth.**
4. Remove the mist shield if it is attached. See **Figure 19**. Wipe inside and outside surfaces of the mist shield with the towel. Wipe the top surface of the instrument base, and all exposed surfaces of the instrument.
5. If detergent was used, wipe all surfaces with a cloth moistened with water.
6. Use a clean, dry cloth to dry all wet surfaces.
7. Disconnect the tubing from the back of the manifold. See **Figures 11** through **17**.
8. Remove and clean the manifold:
 - Using a lint-free disposable towel moistened with water, or with water and mild detergent, thoroughly clean the outside of the dispense and aspirate tubes.
 - Run hot water through both the inlet and outlet fittings. Check to see if water comes out of all of the dispense and aspirate tubes. If not, soak the manifold in hot soapy water and repeat.

Cleaning the Aspirate and Dispense Tubes

8-, 8s-, or 12-Channel Manifold:

1. Using a Phillips screwdriver, unscrew the metal plate on top of the manifold (eight screws). Remove the gasket (rubber top seal) of the manifold.
2. Using hot soapy water and a soft-bristled brush, clean the dispense and aspirate chambers on the manifold top. Thoroughly clean the walls of the chambers.
3. Clean the insides of all of the aspirate and dispense tubes with the appropriate stylus (aspirate or dispense).
4. Rinse the manifold with deionized or distilled water. Look through the tubes to ensure tube openings are clear.
5. When satisfied, replace the gasket and gasket clamp. Do not overtighten.
6. Remount the manifold and replace the tubing. See **Figures 7 and 11** through **17**.
7. Replace the mist shield.
8. Run a Prime program using 200 mL.
9. Verify Dispenser performance visually or by completing the **Dispense Precision Test Procedure**, page 128 for the 8-, 8s-, 12-channel manifold, and page 132 for the 16-channel manifold.

16-Channel Manifold:



Important! Do **not** disassemble the 16-channel manifold. There are five screws on the top metal plate. Removing any of these screws will cause the manifold to **fall out of alignment!**

1. Remove the three black plugs and the T-shaped plug from the manifold.
2. Using the appropriate stylus (aspirate/dispense), clean the insides of all of the aspirate and dispense tubes.
3. Rinse the manifold with deionized or distilled water. Check to see if water comes out of all of the dispense and aspirate tubes.
4. When satisfied, replace all of the plugs.
5. Remount the manifold and replace the tubing. See **Figures 8, 13, 15a, 15b, and 16**.
6. Replace the mist shield.

7. Run a Prime program using 200 mL.
8. Verify dispenser performance visually or by completing the ***Dispense Precision Test Procedure***, page 128 for the 8-, 8s-, 12-channel manifold; page 132 for the 16-channel manifold.

Cleaning the Carrier

If liquid has overflowed onto the microplate carrier, some crystal buildup may occur, preventing the microplate from seating correctly onto the carrier. The aspiration carrier in the ELx50™/8FMW washer may also have some residual buildup, which can prevent proper seating of filter-bottom plates.

Refer to the instructions below and on the following page for cleaning the microplate and aspiration carriers. See ***Figures 7 through 10 in Chapter 2, Installation***, for illustrations of the microplate and aspiration carriers.

Microplate Carrier



Important! Each microplate carrier is specifically aligned to each washer. **Do not** adjust the nylon screws or interchange the carrier with another.

1. Turn the washer on, wait for the self-test to complete, then turn the washer off. Make sure the manifold and tubes are resting above the priming trough ("home" position).
2. Remove the carrier:
 - Carefully lift the carrier *front* off the rail, avoiding contact with the manifold tubes.
 - Carefully lift the carrier *rear* off the rail, avoiding contact with the manifold tubes.
3. Clean the carrier using soap and water or 70% isopropyl alcohol.
4. Replace the carrier:
 - Hold the carrier over the rail so that the trough is to the rear of the washer.
 - Line up the pin on the underside of the carrier with the slot on the carrier transport.
 - Snap the two carrier clips onto the rail. The pin should sit in the slot.

Aspiration Carrier (ELx50™/8FMW only)

1. Turn the washer on, wait for the self-test to complete, then turn the washer off. Make sure the manifold and tubes are resting above the priming trough on the aspiration carrier ("home" position).
2. Disconnect the vacuum tubing between the aspiration carrier and washer.
3. Remove the aspiration carrier:
 - Carefully lift the carrier *front* off the rail, avoiding contact with the manifold tubes.
 - Carefully lift the carrier *rear* off the rail, avoiding contact with the manifold tubes.
4. Unlatch the plate clamp.
5. Rinse the carrier under tap water and allow to dry.
6. Inspect the vent port (labeled "C") on the front of the carrier and the two slots for the vent plugs (labeled "A" and "B") to ensure they are not plugged. If they are plugged, soak the carrier in hot soapy water first, followed by a rinse, and then allow it to air dry.
7. Inspect the plate seal gasket and replace it if it is torn. The gasket is held in place with six screws around the perimeter of the top of the carrier. See **Figure 32** on the next page.
 - If the vacuum grate (located under the gasket) needs to be cleaned, remove the grate, and rinse it under tap water and allow to dry before placing the grate and gasket in the carrier.

❖ **Note:** The gasket is not symmetrical and only goes in one way. When replacing the gasket, align the notch in the gasket with the small "bump" on the plate clamp, as shown in **Figure 32**.
8. Close the plate clamp.
9. Inspect the o-rings on the vent plugs (two o-rings per plug) and replace them if they are worn.
10. Rinse the vacuum tubing under tap water or soak in hot soapy water if extra cleaning is needed.
11. Place the aspiration carrier back into the washer:
 - Hold the aspiration carrier over the rail so that the priming/soaking trough is closest to the rear of the washer.
 - Snap the two carrier rail guides onto the carrier transport rail.

12. Reconnect the vacuum tubing between the aspiration carrier and the washer. Ensure that the tubing is connected to the correct port on the back of the washer, and that there is enough flex room for the tubing during carrier movement. Refer to **Connecting the Tubes and Bottles** in **Chapter 2, Installation**.
13. Verify performance of the aspiration carrier by performing the **Evacuation Efficiency Test** for the carrier on page 134.

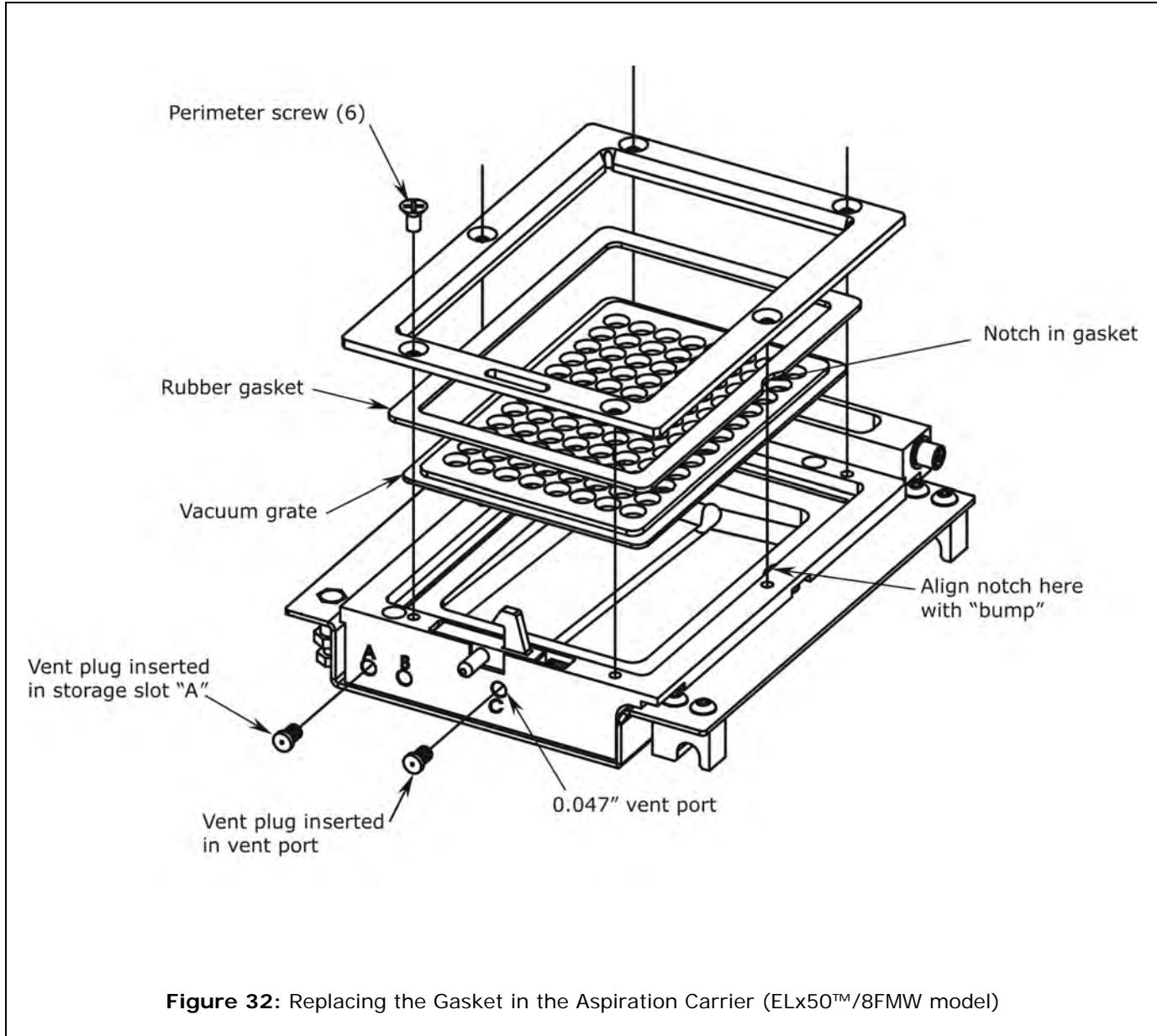


Figure 32: Replacing the Gasket in the Aspiration Carrier (ELx50™/8FMW model)

Cleaning the Check Valves

In the event that the check valves become stuck or leak, you can either clean or replace them. To replace a check valve, contact BioTek Customer Service (check valve PN 68061). To clean a check valve:

1. Pull the tubing off the valve and pull the valve off the syringe pump port. See **Figures 11a** and **12a**.
2. Insert the stylus into the feed end of the valve to hold it open (observe the arrow on the valve indicating the feed direction).
3. Flush with hot water. If necessary, the check valve body twists open to allow disassembly and cleaning of internal components. Note proper orientation for re-assembly.
4. Replace the valve and the tubing.

Long-Term Storage Maintenance

Before leaving the washer unused for a long period of time, you should run the LONG_SHUTDOWN maintenance program below for the manifold and tubes. This program performs three steps:

1. Flushes and soaks the supply tubing and manifold with disinfectant.
2. Flushes the system with rinse.
3. Purges the system of fluid.

If your washer has the aspiration carrier (ELx50™/8FMW model) you should also disinfect the carrier as instructed on the following page.

LONG_SHUTDOWN

Prepare an aqueous solution of 0.5% sodium hypochlorite (NaClO, or bleach). Be sure to check the percent NaClO of the bleach you are using; this information is printed on the side of the bottle. Commercial bleach is typically 10% NaClO; if this is the case, prepare a 1:20 dilution. Household bleach is typically 5% NaClO; if this is the case, prepare a 1:10 dilution.

Fill one supply bottle with at least 200 mL of disinfectant (bleach solution) and one with at least 400 mL of rinse (deionized water). You also need one empty supply bottle (this is the “air” bottle). Empty the waste bottle. If the washer is equipped with automatic valve switching, connect all bottles.

To run the LONG_SHUTDOWN program, follow the washer menu paths shown below.

Washers not equipped with automatic valve switching:

```
MAINT → Press the Option key until
LONG_SHUTDOWN appears → CONNECT DISINFECTANT
AND PRESS <START> KEY → MAINTENANCE RUNNING
PRESS <STOP> TO QUIT.
```

Note: While this program is running, you will need to periodically check the display panel and follow the instructions for changing the supply bottles.

Washers equipped with automatic valve switching:

```
MAINT → Press the Option key until
LONG_SHUTDOWN appears → DISINFECTANT VALVE? A
B C → RINSE VALVE? A B C → AIR VALVE? A B C →
START MAINTENANCE? YES → MAINTENANCE RUNNING
PRESS <STOP> TO QUIT.
```

Disinfect the Aspiration Carrier (ELx50™/8FMW)

- ❖ Do not insert a filter-bottom plate into the aspiration carrier for the following procedure. Disinfectant and rinse solutions will be dispensed into the empty carrier.

1. Prepare an aqueous solution of 0.5% sodium hypochlorite (NaClO, or bleach).
 - Be sure to check the percent NaClO of the bleach you are using; this information is printed on the side of the bottle. Commercial bleach is typically 10% NaClO; if this is the case, prepare a 1:20 dilution. Household bleach is typically 5% NaClO; if this is the case, prepare a 1:10 dilution.
2. Fill one supply bottle with disinfectant (bleach solution).
3. Fill another supply bottle with rinse (deionized water).
4. Empty the waste bottle.
5. Insert the black vent plug that has the 0.020" diameter hole into the vent port on the front panel of the carrier. (See **Figure 10** in **Chapter 2, Installation**, for a close-up illustration of the vent port and vent plugs.)
6. Run a 600 μ l Dispense program for 12 strips using the disinfectant.
7. Run an Aspirate program: select BOT for the ASPIRATE TYPE and 20 (seconds) for the BOT ASPIRATE TIME.
8. Run a 600 μ l Dispense for 12 strips again, this time using the rinse, followed by a final 20-second bottom aspiration to purge the system.

Storing the ELx50™

1. Follow the **Long-Term Storage Maintenance** steps, as described on the previous page and above.
2. Disconnect the washer from its power source.
3. Store the washer on a flat surface that is relatively free of vibration, in a dust- and particle-free environment.
4. Protect the washer from temperature extremes that can cause condensation within the unit and from corrosive fumes and vapors.
5. Store the washer under the following environmental conditions:
 - **Temperature:** -20° to 50°C (-4° to 122°F)
 - **Relative humidity:** 10% to 85% (non-condensing)

Decontamination

Purpose

Any laboratory instrument that has been used for research or clinical analysis is considered a biohazard and requires decontamination prior to handling.

Decontamination minimizes the risk to all who come into contact with the instrument during shipping, handling, and servicing. Decontamination is required by the U.S. Department of Transportation regulations.

Persons performing the decontamination process must be familiar with the basic setup and operation of the instrument.

	<p>Important! BioTek Instruments, Inc. recommends the use of the following decontamination solutions and methods based on our knowledge of the instrument and recommendations of the Centers for Disease Control and Prevention (CDC). Neither BioTek nor the CDC assumes any liability for the adequacy of these solutions and methods. Each laboratory must ensure that decontamination procedures are adequate for the Biohazard(s) they handle.</p>
	<p>Wear prophylactic gloves when handling contaminated instruments. Gloved hands should be considered contaminated at all times; keep gloved hands away from eyes, mouth, nose and ears. Eating and drinking while decontaminating instruments is not advised.</p>
	<p>Mucous membranes are considered prime entry routes for infectious agents. Wear eye protection and a surgical mask when there is a possibility of aerosol contamination. Intact skin is generally considered an effective barrier against infectious organisms; however, small abrasions and cuts may not always be visible. Wear protective gloves when performing the decontamination procedure.</p>

Tools and Supplies

- Sodium hypochlorite (NaClO or bleach)
- 70% isopropyl alcohol (as an alternative to bleach)
- Deionized or distilled water
- Safety glasses
- Surgical mask
- Protective gloves
- Lab coat
- Biohazard trash bags
- 125 mL beakers
- Clean cotton cloths or paper towels
- **Cleaning solution/disinfectant:**

Prepare an aqueous solution of 0.5% sodium hypochlorite (NaClO, or bleach).

As an alternative, 70% isopropyl alcohol may be used if the effects of bleach are a concern. Be sure to check the percent NaClO of the bleach you are using; this information is printed on the side of the bottle. Commercial bleach is typically 10% NaClO; if this is the case, prepare a 1:20 dilution. Household bleach is typically 5% NaClO; if this is the case, prepare a 1:10 dilution.

❖ **Note:** Do not prepare a stronger bleach solution than described here. Extended exposure to high concentrations of bleach can deteriorate some waste system components.



Warning! Internal Voltage. Turn off and disconnect the ELx50™ from its power supply for all decontamination operations.



The bleach solution is caustic; wear gloves and eye protection when handling this solution.

Do not immerse the instrument, spray it with liquid, or use a “wet” cloth. Do not allow the cleaning solution to run into the interior of the instrument. If this happens, contact the BioTek Service Department.

Do not soak the keypad—this will cause damage.

Decontamination Procedure for External Components

1. Prepare the cleaning solution as described on page 118.
2. Turn off and unplug the instrument.
3. Moisten a cloth with the bleach solution or alcohol. **Do not soak the cloth.**
4. Wipe the keypad (do not soak). Wipe again with a clean cloth moistened with deionized or distilled water. Dry immediately with a clean, dry cloth.
5. Remove the mist shield, if it is attached. Wipe the mist shield's inside and outside surfaces. Wipe the microplate carrier, top surface of the instrument base, supply bottles and tubing, and all exposed surfaces of the instrument.
6. Wait 20 minutes. Moisten a cloth with DI or distilled water and wipe all surfaces of the instrument that have been cleaned with the bleach solution or alcohol.
7. Use a clean, dry cloth to dry all wet surfaces.
8. Reassemble the instrument as necessary.
9. Discard the used gloves and cloths using a Biohazard trash bag and an approved Biohazard container.

Decontamination Procedure for Tubing and Manifold

1. Perform the Decontamination procedure described on the previous page.
2. Connect the ELx50™ to the power supply, and turn it on.
3. Prepare to run the DECONTAMINATION program, to decontaminate the internal tubing and manifold parts. This program will consume approximately 55 mL of disinfectant and 55 mL of rinse. Start with an empty waste bottle.
4. To run the DECONTAMINATION program, follow one of two washer menu paths shown below. **Note:** While the program is running, you will need to periodically check the display panel and follow the instructions for changing the supply bottles.

Washers not equipped with automatic valve switching:

```
MAINT → Press the Option key →
DECONTAMINATION → CONNECT DISINFECTANT AND
PRESS <START> KEY → RUNNING: DECONTAMINATION/
DISINFECTION → CONNECT RINSE BOTTLE AND PRESS
<START> KEY → RUNNING: DECONTAMINATION/
RINSING
```

Washers equipped with automatic valve switching:

```

MAINT → Press the Option key →
DECONTAMINATION → DISINFECTANT VALVE? A B C →
RINSE VALVE? A B C → START MAINTENANCE? YES →
MAINTENANCE RUNNING PRESS <STOP> TO QUIT.

```

5. To ensure that all bleach is removed from the instrument, run the DAY_RINSE program at least once after decontamination.

Alternate Decontamination Procedure for Tubing and Manifold

If you are unable to run the decontamination program due to a system failure, decontaminate the internal tubing and manifold parts as follows:

1. Prepare the cleaning solution as described on page 118.
2. Turn off and unplug the instrument.
3. Remove the tubing and manifold.
4. Soak the tubing and manifold in the bleach or alcohol solution.
5. Wait 20 minutes. Rinse the tubing and manifold with DI water.
6. Use a clean, dry cloth to dry all wet surfaces of the tubes and manifold.
7. Reassemble the instrument as necessary.
8. Discard the used gloves and cloths using a Biohazard trash bag and an approved Biohazard container.

Decontamination Procedure for Aspiration Carrier (ELx50/8FMW)

- ❖ If your washer is the ELx50™/FMW model, perform the following instructions to decontaminate the aspiration carrier.

1. Prepare the cleaning solution as described on page 118.
2. Turn off and unplug the instrument.
3. Disconnect the tubing from the back of the aspiration carrier.
4. Remove the aspiration carrier:
 - Carefully lift the carrier *front* off the rail, avoiding contact with the manifold tubes.
 - Carefully lift the carrier *rear* off the rail, avoiding contact with the manifold tubes.

5. Unlatch the plate clamp.
6. Remove the vacuum grate, which is located under the plate seal gasket. The vacuum grate and gasket are held in place with six screws around the perimeter of the top of the carrier. See *Figure 32* on page 113.
7. Soak the carrier, plate clamp, vacuum grate, and gasket in the bleach solution for 20 minutes.
8. Rinse the carrier, plate clamp, vacuum grate, and gasket thoroughly to remove all bleach.
9. Use a clean, dry cloth to dry all wet surfaces.
10. Place the vacuum grate and gasket back into the carrier and replace the six perimeter screws.

❖ **Note:** The gasket is not symmetrical and only goes in one way. When replacing the gasket, align the notch in the gasket with the small "bump" on the plate clamp, as shown in *Figure 32*.

11. Close the plate clamp.
12. Replace the aspiration carrier:
 - Hold the aspiration carrier over the rail so that the priming/soaking trough is closest to the rear of the washer.
 - Snap the two carrier rail guides onto the carrier transport rail.
13. Reassemble the instrument, as necessary.

Performance Verification

Performance verification for the ELx50™ involves three activities: qualification of installation and setup, qualification of routine capability, and qualification of long-term stability. This section refers to these activities as Installation Qualification (IQ), Operational Qualification (OQ), and Performance Qualification (PQ), respectively.

❖ **Note:** An Installation-Operational-Performance Qualification (IQ-OQ-PQ) package (PN 4070530) for the ELx50™ is available for purchase. Contact your local dealer for more information.

The **Recommended Maintenance** and **Performance Verification Schedules** on pages 99 and 100 defines factory-recommended intervals for verification tests for a washer used two to five days a week. Verification tests include the following:

- The **System Self-Test** checks the vacuum pump and syringe pump, manifold, and microplate carrier positioning and operation. The **Checksum Test** verifies the basecode software against internal checksum values.
- The **Evacuation Efficiency Test** for the 8-, 8s-, 12-, and 16-channel manifolds measures the average residual volume per well after a wash program is performed. A solution is dispensed into all the wells of a previously weighed microplate. The wash program is run and the plate is weighed again in order to calculate the total residual, based on the weight difference. The lower the residuals per well, the better the evacuation efficiency of the washer.

The Evacuation Efficiency Test for the **aspiration carrier** verifies that the washer effectively aspirates all fluid down through the wells of a 96-well filter-bottom microplate. A Link program is run for dispensing deionized water into all wells of the plate, followed by bottom-aspiration of the wells. After the program completes, visual verification confirms that there is no residual fluid in any of the wells. If the Millipore filter-bottom plate recommended by BioTek is used, the test also measures the residual volume of the plate after evacuation.

- The **Dispense Precision Test** measures the variability of volumes dispensed from tube to tube across the manifold. A test dye solution is dispensed into a microplate. The optical density of each well is measured at 630 nm and the background at 450 nm is subtracted to account for scratches in the plate or particulates in the well.

The average percent error is calculated, and the amount dispensed for each well is calculated and the %Coefficient of Variation (%CV). It is the %CV, or the ratio expressed in percent, of the standard deviation of the distribution of fluid volumes in the wells, to the mean value of volume per well. The lower the CV, the better the uniformity across the manifold.

Installation Qualification (IQ)

Installation Qualification confirms that the washer and its components have been supplied as ordered and ensures that they are assembled and configured properly for your lab environment.

- The recommended IQ procedure consists of setting up the instrument as described in **Chapter 2, Installation** and then performing the System Self-Test and the Checksum test.
- The IQ procedure should be performed *initially* (before the washer is used for the first time).
- The successful completion of the IQ procedure verifies that the instrument is installed correctly. The Operational Qualification procedure should be performed immediately following the successful IQ (see below).

Operational Qualification (OQ)

Operational Qualification confirms that the washer operates according to specification initially and over time.

- The recommended OQ procedure consists of performing the System Self-Test and the Checksum, Evacuation Efficiency, and Dispense Precision tests.
- Your facility's operating policies may also require that you perform an actual assay prior to accepting the washer for routine use. You should not use the data obtained from the first assay that utilizes the washer until you have confirmed that the package insert criteria have been met.
- The OQ procedure should be performed *initially* (before first use) and then routinely; the recommended interval is *annually*. It should also be performed after any major repair or upgrade to the hardware or software.
- Although out-of-tolerance failures will be detected by the OQ tests, results should be compared with those from the monthly Performance Qualification tests and previous OQ tests to monitor for trends.
- The successful completion of the OQ procedure, in combination with results that are comparable to previous PQ and OQ tests, confirms that the washer is performing consistently over time.

Performance Qualification (PQ)

Performance Qualification confirms that the washer consistently meets the requirements of the tests performed at your laboratory.

- The recommended PQ procedure consists of performing the System Self-Test and the Checksum, Evacuation Efficiency, and Dispense Precision tests.
- Your facility's operating policies may also require that you routinely perform an actual assay, to confirm that the washer will consistently give adequate results for the assays to be run with it.
- These tests should be performed routinely; the recommended interval is *monthly*. This frequency may be adjusted depending on the trends observed over time.
- The successful completion of the PQ procedure confirms that the washer is performing consistently under normal operating conditions.

Self-Test and Checksum Test

The Self-Test (**SLFCHK**) and Checksum Test (**CHKSUM**) are performed automatically whenever the instrument is turned on. They can also be performed manually from the ELx50™ Main Menu.

- The **Self-Test** checks the vacuum, manifold, and manifold-to-carrier movement.
- The **Checksum Test** compares the onboard software with internally recorded checksum values to ensure that no corruption has occurred.

Self-Test

To run the Self-Test, select the following from the Main Menu:

UTIL → TESTS → SLFCHK

If the test passes, the Main Menu is displayed and the washer is ready for use. If the test fails, the washer will “chirp” and display an error code. Press **STOP** to stop the beep, then look up the code in *Appendix A, Error Codes*.

Configuration Information (CHKSUM)

To run the Checksum Test, select the following from the Main Menu:

UTIL → TESTS → CHKSUM

The initial checksum test displays the onboard (basecode) software part number, version, and checksum:

4070xxx Verx.xx

CODE CHECKSUM: (DDA7)

After a few moments, the second checksum test displays the customer configuration software part number and version:

4070xxx-FW vx.xx.x

This information is important if you need to contact BioTek TAC.

Liquid Tests for the 8-, 8s- and 12-Channel Manifolds

Evacuation Efficiency and Dispense Precision Tests

The **Evacuation Efficiency** test measures the average residual volume per well after evacuation. The lower the residuals per well, the better the evacuation efficiency of the washer. The **Dispense Precision** test measures the variability of the volumes dispensed from tube to tube across the manifold. It is the %CV, or the ratio expressed in percent, of the standard deviation of the distribution of fluid volumes in the wells, to the mean value of volume per well. The lower the CV, the better the uniformity across the manifold.

Materials

- Corning Costar® #3590 96-well plates (or equivalent)
- Precision balance with capacity of 100 g minimum and readability of 0.001 g resolution
- Pipettes and graduated beakers
- Microplate absorbance reader capable of dual wavelength reading at 630 and 450 nm
- Test solutions:

Solution #1: 0.1% Tween® 20 in deionized water

- Pipette 1 mL Tween 20 into 1 liter (1000 mL) of deionized water and mix well, **or**
- Pipette 10 mL of BioTek Solution #1 100X Concentrate Wetting Agent (PN 7773002) into 1 liter of deionized water and mix well.

Solution #2: Residual Test Solution

- Mix 100 mL of Solution #1 with 0.0500 grams of FD&C #1 blue dye, **or**
- Mix 10 mL of BioTek Solution #2 10X Concentrate Blue Test Dye (PN 7773001) with 90 mL of Solution #1 prepared above

Solution #3: Dispense Precision Solution

- Mix 590 mL of deionized water with 10 mL of either Solution #2 prepared above.



Important! The factory determined the pass/fail specifications for the following tests using the test solutions described here.

❖ **Note:** PN 7773002 contains 10% Tween® 20 in deionized water and 0.01% Sodium Azide as a preservative. PN 7773001 contains 5 g per liter of FD&C Blue #1, 0.1% Tween 20 in deionized water, and 0.01% Sodium Azide as a preservative.

You may use your own buffer solution in place of Solution #1. If any tests fail using your own buffer, however, retry the tests using the suggested solutions. Using pure DI water in place of Solution #1 is **not** recommended and will likely result in the failure of the unit to meet specifications.

There is a **Liquid Tests Worksheet** on page 129, for recording data reduction results. If your tests are failing, this information will be useful for BioTek TAC to help diagnose any problems.

Evacuation Efficiency Test Procedure



Important! Specifications for the following Evacuation Efficiency Test only apply when the correct microplate carrier is in use. Use the carrier that is specific to the manifold type (see **Carrier Variations** in **Chapter 1, Introduction**). Do **not** use the aspiration carrier for this test!

1. Adjust the wash program for optimal residual. Place a clean, dry 96-well microplate on the balance, then zero the balance.
2. Prime the washer with the test solution, then run the dispense program `accuracy_qc_test`. Run the wash program.
3. Weigh the microplate containing the residual.
4. Calculate and report the average residual by dividing the net weight by the number of wells dispensed.

Example:

$$\frac{\text{NW}}{\# \text{ wells dispensed}} = \text{average residual}^*$$

* The average residual must be ≤ 0.002 grams per well.

If this test does not pass on the initial attempt, clean the aspirate tubes with a stylus and adjust the programmed aspiration height and horizontal aspiration position to minimize residual. Add a crosswise aspiration on the final aspiration step if needed, and then retest.

Dispense Precision Test Procedure

1. Use a clean, dry 96-well microplate.
2. Prepare the washer to dispense test solution to the microplate (see **Materials**).
 - The Test Solution should contain your buffer solution or 0.1% Tween® 20 in deionized water. Add 1 mL Tween 20 into 1 liter (1000 mL) of deionized water.
 - Add enough colored dye to the solution to produce an absorbance of between 0.70 and 1.30 OD when dispensing 300 μ L into the microwell. The formulation will vary, depending on dye purity.
3. Prime the washer with the test solution, then run the dispense program accuracy_qc_test. Use the number keys to enter the number of strips to process (6 for the 8- or 8s-channel manifold and 4 for the 12-channel manifold).
4. Read the plate in an absorbance reader (blank on air) using the dual-wavelength method (630-450 nm), to reduce the influence of scratches and foreign particles that could be in the well. Print or export the results.

❖ **Note:** If you are using one of BioTek's keypad-based readers, such as the ELx800™ or ELx808™, ensure that the reader is not running in Rapid mode. To check this, select UTIL → READ and cycle through the prompts until you see READ IN RAPID MODE?, then choose NO for an accurate result.

5. Calculate and report the mean absorbance, standard deviation, and % Coefficient of Variation (%CV) for the group of wells that were filled. A %CV greater than 3.0% is a failure. If your result is greater than 3.0%, clean the dispense tubes with a stylus and retest.

Example:

Data:

Mean Absorbance = <OD> = 1.026

Standard Deviation = SD = 0.010

Calculation:

% Coefficient of Variation = $\frac{SD}{\langle OD \rangle} \times 100 = \frac{0.010}{1.026} \times 100 = 0.98\%$

If this test does not pass on the initial attempt, use the stylus to clean the dispense tubes that have OD reading results lower than average, and then retest.

Liquid Tests Worksheet (8-, 8s-, and 12-Channel Manifolds)

Washer Serial Number:	
Date:	
Tested By:	

Evacuation Efficiency Test	
Total Residual Weight	grams
Verification that no well varies considerably from the others	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
Mean Residual Weight (Total Residual Weight ÷ 96)	grams
Mean Residual Weight must be \leq 0.002 g	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Dispense Precision Test	
Standard Deviation <i>Calculate using a spreadsheet program</i>	
Mean Absorbance (sum of all wells ÷ 96)	
% Coefficient of Variation (%CV) $= (\text{Standard Deviation} \div \text{Mean Absorbance}) * 100$	
%CV value must be \leq 3.0	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Comments:

Liquid Tests for the 16-Channel Manifold

Evacuation Efficiency and Dispense Precision Tests

The **Evacuation Efficiency** test measures the average residual volume per well after evacuation. The lower the residuals per well, the better the evacuation efficiency of the washer. The **Dispense Precision** test measures the variability of the volumes dispensed from tube to tube across the manifold. It is the %CV, or the ratio expressed in percent, of the standard deviation of the distribution of fluid volumes in the wells, to the mean value of volume per well. The lower the CV, the better the uniformity across the manifold.

Materials

- Corning Costar® 384-well plates
- Precision balance with capacity of 100 g minimum and readability of 0.001 g resolution
- Pipettes and graduated beakers
- Microplate absorbance reader capable of dual wavelength reading at 630 and 450 nm
- Test solutions:

Solution #1: 0.1% Tween® 20 in deionized water

- Pipette 1 mL Tween 20 into 1 liter (1000 mL) of dionized water and mix well, **or**
- Pipette 10 mL of BioTek Solution #1 100X Concentrate Wetting Agent* (PN 7773002) into 1 liter of deionized water and mix well.

Solution #2: Residual Test Solution

- Mix 100 mL of Solution #1 with 0.0500 grams of FD&C #1 blue dye, **or**
- Mix 10 mL of BioTek Solution #2 10X Concentrate Blue Test Dye* (PN 7773001) with 90 mL of Solution #1 prepared above.

Solution #3: Dispense Precision Solution

- Mix 590 mL of deionized water with 10 mL of either Solution #2 prepared above.



Important! The factory determined the pass/fail specifications for the following tests using the test solutions described here.

❖ **Note:** PN 7773002 contains 10% Tween® 20 in deionized water and 0.01% Sodium Azide as a preservative. PN 7773001 contains 5 g per liter of FD&C Blue #1, 0.1% Tween 20 in deionized water, and 0.01% Sodium Azide as a preservative.

You may use your own buffer solution in place of Solution #1. If any tests fail using your own buffer, however, retry the tests using the suggested solutions. Using pure DI water in place of Solution #1 is **not** recommended and will likely result in the failure of the unit to meet specifications.

There is a **Liquid Tests Worksheet** on page 133, for recording data reduction results. If your tests are failing, this information will be useful for BioTek TAC to help diagnose any problems.

Evacuation Efficiency Test Procedure



Important! Specifications for the following Evacuation Efficiency Test only apply when the correct microplate carrier is in use. Use the carrier that is specific to the 16-channel manifold.

1. Adjust the wash program for optimal residual. Place a clean, dry 384-well microplate on the balance, then zero the balance.
2. Prime the washer with the test solution, then run the dispense program `accu_rc_test 38 4`. Run the wash program.
3. Weigh the microplate containing the residual.
4. Calculate and report the average residual by dividing the net weight by the number of wells dispensed.

Example:

$$\frac{\text{NW}}{\# \text{ wells dispensed}} = \text{average residual}^*$$

* The average residual must be ≤ 0.004 grams per well.

If this test does not pass on the initial attempt, clean the aspirate tubes with the stylus and adjust the programmed aspiration height and horizontal aspiration position to minimize residual. Add a crosswise aspiration on the final aspiration step if needed, and then retest.

Dispense Precision Test Procedure

1. Use a clean, dry 384-well microplate.
2. Prepare the washer to dispense test solution to the microplate (see **Materials**).
 - The Test Solution should contain your buffer solution or 0.1% Tween® 20 in deionized water. Add 1 mL Tween 20 into 1 liter (1000 mL) of deionized water.
 - Add enough colored dye to the solution to produce an absorbance of between 0.70 and 1.30 OD when dispensing 300 μ L into the microwell. The formulation will vary depending on dye purity.
3. Prime the washer with the test solution, then run the dispense program `accu_qc_test 384`. Use the number keys to enter the number of strips to process (6 for the 16-channel manifold).
4. Read the plate in an absorbance reader (blank on air) using the dual-wavelength method (630-450 nm), to reduce the influence of scratches and foreign particles that could be in the well. Print or export the results.

❖ **Note:** If you are using one of BioTek's keypad-based readers, such as the ELx800™ or ELx808™, ensure that the reader is not running in Rapid mode. To check this, select UTIL ➔ READ and cycle through the prompts until you see READ IN RAPID MODE?, then choose NO for an accurate result.

5. Calculate and report the mean absorbance, standard deviation, and the % Coefficient of Variation (%CV) for the group of wells that were filled. A %CV greater than 4.0% is a failure. If your result is greater than 4.0%, clean the dispense tubes with a stylus and retest.

Example:

Data:

Mean Absorbance = <OD> = 1.200

Standard Deviation = SD = 0.040

Calculation:

% Coefficient of Variation = $\frac{SD}{\langle OD \rangle} \times 100 = \frac{0.040}{1.200} \times 100 = 3.3\%$

If this test does not pass on the initial attempt, use the stylus to clean the dispense tubes that have OD reading results lower than average, and then retest.

Liquid Tests Worksheet (16-Channel Manifold)

Washer Serial Number:	
Date:	
Tested By:	

Evacuation Efficiency Test	
Total Residual Weight	grams
Verification that no well varies considerably from the others	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
Mean Residual Weight (Total Residual Weight ÷ 384)	grams
Mean Residual Weight must be \leq 0.004 g	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Dispense Precision Test	
Standard Deviation <i>Calculate using a spreadsheet program</i>	
Mean Absorbance (sum of all wells ÷ 384)	
% Coefficient of Variation (%CV) $= (\text{Standard Deviation} \div \text{Mean Absorbance}) * 100$	
%CV value must be \leq 4.0	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Comments:

Liquid Test for the Aspiration Carrier (ELx50/8FMW)

Evacuation Efficiency Test

The **Evacuation Efficiency** test for the aspiration carrier on the ELx50™/8FMW model verifies that the washer effectively aspirates all fluid down through the wells of a

96-well filter-bottom microplate. The test is based on *visual* verification that there is no residual fluid left in any of the wells. If the Millipore plate recommended by BioTek is used (see PN below), the test also measures the residual volume of the plate after evacuation. The lower the residual weight (< 1 gram), the better the evacuation efficiency of the washer.

Materials

- One new 96-well filter-bottom plate:
0.45 μ m filter pore size (recommended: Millipore PN MSHVN4550)
- Precision balance with capacity of 100 g minimum and readability of 0.001 g resolution
- Deionized water

❖ Although BioTek recommends that you use the Millipore filter-bottom plate listed above for this test, you may substitute other manufacturers' filter-bottom plates that you are most familiar with using. Using a substitute plate, however, **may vary your test results.**

There is a Liquid Test Worksheet on page 136, for recording test results. If your tests are failing, this information will be useful for BioTek TAC to help diagnose any problems.

Evacuation Efficiency Test Procedure



Important! Before performing the Evacuation Efficiency Test, ensure that the aspiration carrier is installed.

Perform the following test using the 0.45 μ m filter pore plate:

1. Prime the washer using deionized water.
2. If you are using the Millipore PN MSHVN4550 plate, place the plate on the balance, then zero the balance.

3. Ensure that there is proper vacuum. Use the vent port (labeled "C") on the carrier and the two vent plugs (located in storage slots "A" and "B") to vary the vacuum levels.

(See **Figure 9** in **Chapter 2** for an illustration of the vent port and the two vent plugs.)

- For a **low** vacuum level, leave the vent port on the carrier open. The vent port is a 0.047" diameter hole, which is equal to approximately -64 mmHg.
- For a **medium** vacuum level, insert the gray vent plug into the vent port. The gray vent plug contains a 0.032" diameter hole, which is equal to approximately -116 mmHg.
- For a **high** vacuum level, insert the black vent plug into the vent port. The black vent plug contains a 0.020" diameter hole, which is equal to approximately -240 mmHg.

❖ The approximate vacuum levels listed above (-64, -116, and -240 mmHg) are "typical" only, and may vary, depending upon factors such as relative humidity, barometric pressure, and mechanical tolerances.



Important! Ensure that the vent port is not completely sealed. If the vent port is sealed, the washer's internal vacuum pump may collapse the vacuum reservoir bottle.

4. Run a Link program: select BTST.
5. Immediately after the program completes, visually verify that all wells have been evacuated.
6. Pat the bottom of the plate with a paper towel to remove any droplets.
7. If using the Millipore plate, weigh the plate and verify that the weight is less than 1 gram.

❖ The 1 gram weight specification is specifically for Millipore part number MSHVN4550. An alternate plate type will need to be tested, and a specification determined for that plate.

8. Enter the weight in the worksheet on the following page.
9. If the test fails, repeat using another new plate.

Liquid Test Worksheet (Aspiration Carrier)

Washer Serial Number:	
Date:	
Tested By:	

Evacuation Efficiency Test	
0.45 µm filter pore size, 96-well plate	
Manufacturer brand and part number for the plate:	
Visual verification that all wells have been evacuated:	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
Residual Weight:	grams
Residual Weight (Millipore MSHVN4550 only) must be < 1 g	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Maintenance/Performance and Operational Logs

Maintenance/Performance and Operational logs are provided on the following pages.

ELx50™ Serial Number:

ELx50™ Serial Number:

MAINTENANCE / PERFORMANCE AND OPERATIONAL QUALIFICATION		DATE
Clean bottles		
Empty waste bottle		
Clean manifold and mist shield		
Clean aspirate and dispense tubes		
Clean microplate carrier		
Clean aspiration carrier		
Clean check valves		
Perform Long_Shutdown (if needed, for storage)		
Perform Decontamination		
Perform Self-Test		
Perform/Record Checksum Test (compare to initial checksum)		
8-, 8s-, 12-, 16-Channel Manifold:		
Perform Evacuation Efficiency Test: Residual Weight/Well		
≤ 0.002 g for 8-, 8s-, 12-Channel		
≤ 0.004 g for 16-Channel		
Perform Dispense Precision Test: %CV $\leq 3.0\%$ for 8-, 8s-, 12-Channel		
%CV $\leq 4.0\%$ for 16-Channel		
Aspiration Carrier:		
Perform Evacuation Efficiency Test: All wells evacuated		
If Millipore MSHVN4550 plate used, Residual Weight < 1 g		
Operator's Initials		

Chapter 5

Troubleshooting

This chapter lists problems that you may experience with the ELx50™ washer, and suggests possible solutions for these problems.

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Overview

Every effort has been made to ensure that the ELx50™ Microplate Strip Washer is extremely reliable and easy to use. Nevertheless, you could experience problems with the washer hardware, software, and/or accessories. This chapter offers information to help resolve these problems.

The table below is a concise summary of possible causes for many of the problems that may occur during operation of the washer.

The troubleshooting charts on the following pages provide detailed lists of problems, their possible causes, and possible solutions.

Troubleshooting Checklist

Periodic inspection of the washer, tubing, and bottles for the possible causes listed below may help to eliminate many of the problems listed on the following pages.

Check for the following:	
✓	Loose or incorrect connections of power cord, power supply, waste and supply tubing and fittings
✓	Incomplete or incorrect installation of manifold and carrier, attachment of mist shield, or placement of microplate/strips in carrier
✓	Accumulation of residue on carrier or inside aspirate/dispense tubes, waste/supply bottles and tubing, manifold, inlet/outlet fittings, optional in-line vacuum filter, or optional pump muffler (washers manufactured after January 2008).
✓	Worn tubing, o-rings, inlet or outlet fittings, manifold gaskets or vacuum seals
✓	Kinked or bent aspirate/dispense tubes or waste/supply tubing

Troubleshooting Charts

See **Figures 10 through 15** in **Chapter 2, Installation**, and **Figure 30** in **Chapter 4, Maintenance and Performance Verification (IQ/OQ/PQ)** for illustrations of the components referenced in the Troubleshooting Charts:

Figure 11	Washer Rear Panel (all models except ELx50™/8FMW)
Figure 12	Washer Rear Panel (ELx50/8FMW model)
Figure 13	Waste Tubing Connections (all models except ELx50/8FMW)
Figure 14	Waste Tubing Connections (ELx50/8FMW model with Aspiration Carrier installed)
Figure 15a	Supply Tubing Connections (front view)
Figure 15b	Supply Tubing Connections (view of connections on rear panel)
Figure 16	Washer with Multiple Valve Tubing Connections ("V" versions of the ELx50)
Figure 32	Replacing the Gasket in the Aspiration Carrier (ELx50/8FMW model)

Washer Start-Up

Problem	Possible Cause	Possible Solution
Display (LCD) not on.	Power cord not plugged in or loose.	Check the power connection.
Syringe, carrier, or manifold position error.	Manifold or carrier is being obstructed.	Remove any obstruction. Also, ensure that the manifold and carrier have been properly installed (see Ch. 2, Installation).
	Motor, sensor, or electrical problem.	Turn the washer off, wait at least 15 seconds, then turn it back on. If it fails the self-test, the washer will "chirp" and display an error code. Press the STOP button to stop the beep, and look up the code in App. A, Error Codes . Contact BioTek TAC.
	Misaligned carrier or manifold.	Contact BioTek TAC.

Fluid Aspiration

Problem	Possible Cause	Possible Solution
Poor or uneven aspiration.	Insufficient or no vacuum.	If the optional in-line vacuum filter or optional pump muffler has been installed, the filter or muffler may need to be replaced (see Connecting the Tubes and Bottles in Ch. 2).
		Firmly seat the waste bottle stopper. Ensure that the tubing is connected properly (see Fig. 13: Waste Tubing Connections).
		Check all external tubing for kinks or accumulations of residue.
		When aspiration begins, you should hear the vacuum pump turn on. If the pump does not turn on, contact BioTek TAC.
	Insufficient or no vacuum.	When the vacuum pump turns on, remove the vacuum tubing from the back of the washer while the pump is on (see Fig. 11: Washer Rear Panel). Put your finger over the port; if there is no vacuum, contact BioTek TAC.
	Clogged aspirate tubes on the washer manifold.	Remove and clean the manifold (see Cleaning the Manifold in Ch. 4).
	Microplate aspiration height adjustment too high or too low.	Change the programmed aspiration height (see Define Wash ASPIRATION Program Options in Ch. 3).
	Aspirate tubes not properly positioned horizontally in wells.	If none of the tubes are bent, try adjusting the programmed horizontal aspirate position (see Define Wash ASPIRATION Program Options in Ch. 3).

Fluid Aspiration, *cont'd*

Problem	Possible Cause	Possible Solution
Poor or uneven aspiration, <i>cont'd.</i>	Microplate not level in carrier or strips not level in holder.	Reseat the microplate in the carrier or the strips in their holder.
		Ensure that the carrier is clean (see <i>Cleaning the Carrier</i> in <i>Ch. 4</i>).
		Try a different microplate or strip holder. If the problem is unresolved, the carrier may have to be realigned. Contact BioTek TAC.
	Movement rails misaligned.	Contact BioTek TAC.
Poor or uneven bottom aspiration in aspiration carrier (ELx50/8FMW only)	Clogged vacuum filter or pump muffler.	If the optional in-line vacuum filter or optional pump muffler has been installed, the filter or muffler may need to be replaced (see <i>Connecting the Tubes and Bottles</i> in <i>Ch. 2</i>).
	Clogged filters in filter-bottom plates (ELx50 TM /8FMW model only).	If the plate is old or has been used more than once, the filter paper may be dirty, resulting in poor aspiration. Replace the old plate with a new one. Ensure, also, that the vacuum grate is in place in the aspiration carrier. The grate is located under the plate seal gasket. If this grate is missing, the filter-bottom plate may have drops clinging to the underside of the plate.
		A combination of thick solution and high vacuum level may cause clogging in some filter-bottom plates. For instance, assays with beads may become clogged if a high vacuum level is used. Try a lower vacuum level or filter pore size plate.
		Bottom aspiration times (BOT ASPIRATE TIME) that are too long may cause beads to stick in the bottom of the wells. Try shorter aspiration times <i>initially</i> (e.g., 10 seconds), and then increase the aspiration time until suitable aspiration is achieved.

Fluid Aspiration, *cont'd*

Problem	Possible Cause	Possible Solution
Poor or uneven bottom aspiration in aspiration carrier (ELx50™/8FM W only), <i>cont'd</i> .	Vacuum lines not connected or incorrectly connected.	Ensure that the vacuum lines to the manifold and aspiration carrier are connected. Also, if the lines are reversed, the top and bottom functions will be reversed. If this is the case, reconnect the lines as appropriate.
	Seal did not form.	If the filter-bottom plate is not seated correctly in the aspiration carrier, a seal will not form, resulting in no vacuum. Reposition the plate in the carrier. Also, check for residue on the carrier or carrier transport rails, and clean them, if necessary.
		Check the rubber gasket on the aspiration carrier. If it is worn, there may be air leaks, resulting in a poor or no seal. If this is the case, replace the gasket.
		If all 96 wells do not contain fluid, a seal will not form. Dispense to full plates only.
	Incorrect plate size.	If the filter-bottom plate is the wrong size, a seal will not form, resulting in no vacuum. Try a plate with a different filter pore size.
	Vacuum reservoir bottle is full.	If the vacuum reservoir bottle is full, the vacuum pump will draw fluid into the in-line filter or pump muffler and lower the vacuum level. A full bottle will also result in fluid being drawn into the pump, causing the vacuum level to drop. Empty the bottle.
Too much residual left in microwells after aspiration.	Washer program requires optimization for the plate type used.	To minimize the residuals, program a second or crosswise aspiration (see Define Wash ASPIRATION Program Options in <i>Ch. 3</i>). Other options include decreasing the aspiration rate, increasing or decreasing aspiration height or tube position in the well, or adding a delay on the final aspiration.

Fluid Aspiration, *cont'd*

Problem	Possible Cause	Possible Solution
Too much residual left in microwells after aspiration, <i>cont'd.</i>	Waste bottle stopper not properly sealed or fittings not properly connected.	Firmly seat the waste bottle stopper. Make sure the tubing is connected properly. Ensure that the fittings are properly connected to the manifold.
		Check the fit of the gasket (rubber top seal) on the 8-, 8s-, or 12-channel manifold top (see <i>Cleaning the Manifold in Ch. 4</i>). If the fit is loose, contact BioTek TAC.
	Manifold out of alignment or not moving freely.	Check for obstructions and ensure that the manifold has been properly installed (see <i>Ch. 2, Installation</i>). If no obstructions are found and the manifold is correctly installed, contact BioTek TAC.
	Microplate not level in carrier or strips not level in holder.	Reseat the microplate in the carrier or the strips in their holder.
		Ensure that the carrier is clean (see <i>Cleaning the Carrier in Ch. 4</i>).
		Try a different microplate or strip holder. If the problem is unresolved, the carrier may have to be realigned. Contact BioTek TAC.
	Using 16-channel manifold to wash 8-well strips with round or "V" bottoms.	The 16-channel manifold may not be compatible with all 96-well format strips and plates. This manifold uses two aspirating tubes for each well, and it may be difficult for these tubes to reach the bottom of wells that are not flat.
	Aspirate tubes are bent.	Gently attempt to straighten the tubes using your fingers. If they remain bent, contact BioTek TAC.
<p>Note: Monthly performance of the Evacuation Efficiency test is recommended to verify that the residual volume per well after evacuation (aspiration) meets the specified criteria. See <i>Chapter 4, Performance Verification, Evacuation Efficiency Test Procedure.</i></p>		

Fluid Delivery

Problem	Possible Cause	Possible Solution
Unable to dispense fluid.	Inlet tube not connected at manifold or at bottle.	Check all tubing (see Connecting the Tubes and Bottles in Ch. 2).
	Supply tube inside the supply bottle is kinked or disconnected.	Straighten or connect supply tube. Make sure the end is cut as shown on page 55.
	Clogged dispense tubes on the washer manifold.	Remove and clean the manifold (see Cleaning the Manifold in Ch. 4).
	Check Valve flow direction is incorrect.	Compare the flow direction of the Check Valves with Fig. 11: Washer Rear Panel . Switch or replace if necessary.
	Check Valves are stuck closed.	Clean Check Valves (see Cleaning the Check Valves in Ch. 4).
	Dispense tube not plugged into syringe pump.	Plug dispense tube into top connector of syringe pump.
	No wash or rinse fluid.	Fill bottles with appropriate fluid.
	System not primed.	Run a Prime program using 200 ml.
	Faulty syringe pump.	Contact BioTek TAC.
Plate overfills (floods).	Dispense height too high. The aspirate tubes are too many steps above the microwells to prevent overflow.	Change the Dispense Height in the program (see Define Wash DISPENSE Program Options in Ch. 3).
	Aspirate tubes hit bottom of trough during Prime or Maintenance.	Contact BioTek TAC.
	Fittings to manifold not connected.	Reconnect fittings.
	Optional in-line vacuum filter or optional pump muffler plugged.	Replace or remove the filter or pump muffler.
	Rubber stopper on waste bottle is loose.	Push rubber stopper into waste bottle to create a better seal.
	Dispense rate too fast for volume selected.	Use slower dispense rate or lower volume (see Define Wash DISPENSE Program Options in Ch. 3).
	Insufficient or no vacuum.	Firmly seat the waste bottle stopper. Make sure tubing is connected properly.

Fluid Delivery, cont'd

Problem	Possible Cause	Possible Solution
Plate overfills (floods), cont'd.	Insufficient or no vacuum, cont'd.	Check all external tubing for kinks or clogs.
		The optional in-line vacuum filter or the optional pump muffler may need to be replaced.
		When the program begins, you should be able to hear the vacuum pump turn on. If not, contact BioTek TAC.
		If the vacuum pump is turning on, remove the vacuum tubing from the back of the washer while the vacuum pump is on. Put your finger over the port; if there is no vacuum, contact BioTek TAC.
Units with solenoid valves unable to dispense.	Solenoid valve not opening.	Contact BioTek TAC.
	Solenoid valve tubing disconnected, or wrong solenoid inlet connected.	Reconnect or redirect tubing.
Uneven dispensing of fluid; wells not filled.	Manifold or tubing not adequately primed.	Run a Prime program using 200 ml.
	Dispense flow rate too low.	Select a higher flow rate (see Define Wash DISPENSE Program Options in Ch. 3).
	Clogged dispense tubes on the washer manifold.	Remove and clean the manifold (see Cleaning the Manifold in Ch. 4).
	Microplate aspiration height adjustment too high or too low.	Change the Aspiration Height in the program (see Define Wash ASPIRATION Program Options in Ch. 3).
Dripping dispense tubes.	Dispense tubing routed incorrectly.	The supply bottle tube must enter the syringe at the bottom. Also, check for holes in the manifold gasket.
Note: Monthly performance of the Dispense Precision test is recommended to measure the variability of volumes dispensed from tube to tube across the manifold. See Chapter 4, Performance Verification, Dispense Precision Test Procedure .		

Fluid Leakage

Problem	Possible Cause	Possible Solution
Dripping dispense tubes.	Dispense tubing routed incorrectly.	The supply bottle tube must enter the syringe at the bottom.
Fluid leaking from manifold.	Defective seals.	If 8-, 8s-, or 12-channel manifold, replace manifold gasket. If 16-channel manifold, replace plugs and o-ring on 'T' plug (see Cleaning the Manifold in Ch. 4).
	Defective seals, <i>cont'd.</i>	Replace o-rings on washer manifold inlet fittings. Contact BioTek TAC.
	Teflon® sleeves are defective or missing.	Reposition sleeves. Contact BioTek TAC.
	Check valves are leaking.	Clean or replace check valves (see Cleaning the Check Valves in Ch. 4).
	Aspirate tubes only: vacuum too low.	Check waste connector tubes, and make sure they are properly connected to the manifold. Check vacuum filter for clogging, replace if necessary. Push rubber stopper into waste bottle to create a better seal. Use a slower Aspiration Rate in the program (see Define Wash ASPIRATION Program Options in Ch. 3).
Fluid leaking from underneath the instrument.	Defective tubing connector or inlet tubing.	Contact BioTek TAC.
	Leaking syringe seal.	Contact BioTek TAC.
	Defective syringe piston.	Contact BioTek TAC.
Fluid leaking from external tubing connector.	Defective connector.	Replace connector.
	Worn tubing.	Replace tubing.
	Worn seal (inlet or vacuum fitting).	Replace filter or seal (see Connecting the Tubes and Bottles in Ch. 2).

Carrier Movement

Problem	Possible Cause	Possible Solution
Microplate Carrier		
Aspirate tubes not entering well correctly.	Aspirate tube(s) bent.	Push the stylus needle into the tube and then gently attempt to straighten the tube using your fingers. If it remains bent, contact BioTek TAC.
	Microplate not properly seated or strips not level.	Reseat the microplate in the carrier or the strips in the holder. Make sure the plate is distributed squarely to the front edge of the carrier.
		Make sure the carrier is clean (see <i>Cleaning the Carrier</i> in <i>Ch. 4</i>).
	Horizontal Aspirate Position is programmed too wide for a movement.	Change the Horizontal Aspir Pos value in the program (see <i>Define Wash ASPIRATION Program Options</i> in <i>Ch. 3</i>).
	Manifold tilted.	Check tubing for twists; add manifold screws (PN 12174).
Aspiration Carrier (ELx50/8FMW)		
Aspiration carrier loses steps during program.	Insufficient flex room for tubing between carrier and washer.	Pushing the washer up against a wall or against the vacuum/dispense bottles can reduce the flex room needed by the tubing during carrier movement. Re-position the washer and/or tubing to allow enough room. See <i>Connecting the Tubes and Bottles</i> in <i>Chapter 2</i> .

Washer Manifold Movement

Problem	Possible Cause	Possible Solution
Manifold position error.	Manifold movement is blocked.	<p>Check orientation of microplate; A1 should be in the right rear corner of the plate carrier as you face the front of the instrument.</p> <p>Check for and remove any obstructions.</p> <p>Ensure that the manifold is resting on the manifold support bracket.</p> <p>Contact BioTek TAC.</p>

Microplate Scratches

Problem	Possible Cause	Possible Solution
Scratches on microplate bottom.	Microplate dispense or aspiration height adjustment too low.	Change the Dispense or Aspiration Height in the program (see Define Wash DISPENSE or ASPIRATION Program Options in <i>Ch. 3</i>).
	Microplate not properly seated or strips not level.	Reseat microplate in carrier or strips in holder.
		Make sure the carrier is clean (see Cleaning the Carrier in <i>Ch. 4</i>).
		Try a different microplate or strip holder. If the problem is unresolved, the carrier may have to be realigned. Contact BioTek TAC.

Syringe Drive Movement

Problem	Possible Cause	Possible Solution
Syringe drive gives movement errors.	Check valves incorrectly mounted.	Re-mount check valves.
	Obstructions in syringe path.	Remove any obstructions.

Appendix A

Error Codes

This appendix lists error codes that may appear on the ELx50™ washer. If an error appears, refer to ***Chapter 5, Troubleshooting***. Contact BioTek's Technical Assistance Center if further instructions are necessary.

Error Codes	154
General Errors.....	155
Fatal Errors.....	157
Dispense Volume Invalid for Manifold Type (0F00 Error)	158

Error Codes

An error code is displayed on the ELx50™ Microplate Washer as a four-digit identifier. The first character will be either 0, 1, 2, or A.

- 0 or 1 denote a noncritical (“General”) error, which means that the instrument will still respond to keypad input. See **General Errors** on the following page.
- A denotes a more serious error, which requires that the ELx50™ be turned off and then powered up. Upon restarting the washer, you should be able to enter commands into the keypad. See **Fatal Errors** on page 157.

General Errors

General errors indicate non-fatal conditions that require attention. If an error is displayed, refer to **Chapter 5, Troubleshooting**. Contact BioTek's Technical Assistance Center if further instructions are necessary.

Error	Code	Cause
ABORT_ERR	0100	Wash function aborted.
NO_SENSOR_ERR	0200	Manifold motor couldn't find optical sensor.
	0201	Carrier motor couldn't find optical sensor.
	0202	Syringe motor couldn't find optical sensor.
AUTOCAL_JIG_ERROR	0300	Manifold motor couldn't find edge of jig.
	0301	Carrier motor couldn't find edge of jig.
	0302	Syringe motor couldn't find edge of jig.
MOTOR_VERIFY_ERR	0400	Manifold motor failed positional verify.
	0401	Carrier motor failed positional verify.
	0402	Syringe motor failed positional verify.
UNDEF_PROG_TYPE_ERR	0500	Undefined program type specified.
PROGRAM_NUM_ERR	060n	Invalid program assay number chosen by user (n = program number).
PROGRAM_SET_ERR	0700	Invalid write attempt.
PROGRAM_DEL_ERR	0800	Invalid delete attempt.
SYR_VOLUME_TO_LARGE	0900	Syringe volume too large.
PROGRAM_CHECKSUM_ERR	0A0n	Program checksum failure; indicates corrupt assay program (n = program number).
MANIFOLD_AUTOCAL_ERR	0B00	Invalid manifold for calibration.
INVALID_BUFFER_ERR	0C00	Invalid buffer selected.
CAL_CHECKSUM_ERR	0D00	Failed calibration checksum test.
DISPENSE_RATE_ERR	0E00	Dispense rate is invalid for manifold type.
DISPENSE_VOLUME_ERR	0F00	Dispense volume invalid for manifold type (see page 158).
CNFG_DATA_ERR	1000	Necessary configuration data missing.
CNFG_CHECKSUM_ERR	1100	Failed configuration checksum test.
Note: Calibration errors (AUTOCAL_JIG_ERROR; MANIFOLD_AUTOCAL_ERR; CAL_CHECKSUM_ERR) will normally be displayed only during calibration or repair of the instrument by BioTek TAC.		

Error	Code	Cause
CAL_DATA_ERR	1200	Necessary calibration data missing.
MOTOR_NOT_HOMED_ERR	1300	Manifold motor not homed successfully.
	1301	Carrier motor not homed successfully.
	1302	Syringe motor not homed successfully.
AUTOCAL_ABORT_ERR	1400	Autocal of washer was aborted.
MALLOC_ERR	1900	Memory allocation failure.
ASPIRATE_POS_ERR	1A00	Carrier aspirate position is out of range for present manifold.
DISPENSE_POS_ERR	1B00	Carrier dispense position is out of range for present manifold.
SYRINGE_FMEA_ERR*	1C01	Sensor not found at start of syringe aspirate stroke.
	1C02	Sensor not open at start of dispense stroke.
	1C03	Syringe aspirate stroke failure.
	1C04	Sensor verify after last syringe stroke in program failed.
	1C05	Sensor clear from home position too many steps.
MANIFOLD_POS_ERR	1D00	Manifold position not in table.
AUTOCAL_CHECKSUM_ERR	1E00	Failed autocal checksum.
INVALID_LINK_ERR	2400	Failed to get program to view/run.
CHECK_FLUID_START_ERR	2800	<i>Liquid Level Alert</i> ™ only. A supply bottle's fluid level has dropped below 400/450 mL and/or the waste bottle's fluid level has risen above 1400/1450 mL. Or, the Liquid Level Alert option is enabled (via SETUP > SENSORS) but the select box is not properly connected to the washer. See "Liquid Level Alert" in Chapter 3 under General Usage Guidelines .
CHECK_FLUID_END_ERR	2900	
INCOMPATIBLE_HW_ERR	2A00	Both the bottom aspirate and the external valves jumpers are set. This is not a valid hardware configuration.
SOAK_SHAKE_ERR	3100	Error running shake/soak protocol.
Notes:		
<ul style="list-style-type: none"> Calibration errors (CAL_DATA_ERR; AUTOCAL_ABORT_ERR) will normally be displayed only during calibration or repair of the instrument by BioTek TAC. Syringe errors (SYRINGE_FMEA_ERR) indicate movement problems. 		

Fatal Errors

Fatal errors indicate conditions that require immediate attention. If a fatal error is displayed, contact BioTek's Technical Assistance Center for further instructions.

Error	Code	Cause
TCB_NOT_AVAIL_ERR	A100	Task control block not available.
READ_NOT_AVAIL_ERR	A200	Washer function already in use.
NOT_AVAIL_ERR	A300	Manifold motor not available.
	A301	Carrier motor not available.
	A302	Syringe motor not available.
	A304	Software timer not available.
	A305	Display not available.
	A306	Quick flash memory not available.
CHECKSUM_ERR	A400	Failed code checksum test on power-up; memory corruption.
POWER_ERR	A500	Power dropped below safe level.
QFLASH_TIMEOUT_ERR	A600	Quick flash memory configuration timed out. Memory corruption; contact TAC.
QFLASH_ERR	A700	Quick flash memory read did not match write. Memory corruption; contact TAC.
HEAP_CORRUPTED_ERR	A900	Memory manager corruption detected. Contact TAC.
Note: Unavailability of a motor, software timer, display or quick flash memory (NOT_AVAIL_ERR) may be caused by loose cables. Contact TAC.		

Dispense Volume Invalid for Manifold Type (0F00 Error)

An 0F00 error at run-time indicates a validation error in the washer program, and that the current dispense volume/flow rate combination is invalid for the washer manifold type. The ELx50™ basecode does not perform this type of validation during program creation.

To eliminate this error, edit the washer program and change the Dispense Volume and/or Dispense Flow Rate so that they are compatible with your manifold type.

The following table shows the valid Dispense Volume ranges (in $\mu\text{l}/\text{well}$) for each Dispense Flow Rate/Washer Manifold combination:

Dispense Flow Rate	Dispense Volume Range ($\mu\text{l}/\text{well}$) by Manifold Type			
	8-Channel	12-Channel	16-Channel	
			96-well plate	384-well plate
1	50-3000	50-3000	50-3000	25-3000
2	50-3000	50-3000	50-3000	25-3000
3	50-3000	50-3000	50-3000	25-3000
4	50-3000	50-3000	56-3000	28-3000
5	50-3000	60-3000	60-3000	30-3000
6	50-3000	70-1100	90-3000	45-3000
7	55-3000	70-1100	100-3000	50-3000
8	100-1100	not valid	106-3000	53-3000
9	110-1100	not valid	110-3000	55-3000

For example, if your washer program is currently defined with a Dispense Volume of 1500 $\mu\text{l}/\text{well}$ with a Dispense Flow Rate of 8, and your washer is equipped with the 8-channel manifold, consider reducing the Flow Rate to 7.

See **Define Wash DISPENSE Program Options** in **Chapter 3** for information on editing these parameters.

Appendix B

ELx50 Manifold Variations

This appendix lists the parts you need to purchase and the steps you need to take to reconfigure the ELx50™ Washer to work with a different manifold.

ELx50 Manifold Variations	160
Reconfiguring the Washer	160
Hardware Steps	161
Software Steps	162

ELx50 Manifold Variations

Your ELx50™ Microplate Strip Washer was initially configured for and shipped with either an 8-, 8s-, 12-, or 16-channel manifold. The 8s-channel manifold has short dispense tubes for special applications. The 16-channel manifold is typically used for 384-well plates (16-well strips), but it can also wash 96-well plates (8-well strips).

Your washer *can* be configured to work with a different manifold. The level of difficulty for reconfiguration depends on the type of manifold you have now and the type you plan to use.

Each manifold comes with a microplate carrier that is specific to the manifold type (see **Carrier Variations** in **Chapter 1**). In addition to the microplate carrier, ELx50/8FMW washers also have an aspiration carrier for bottom aspiration of filter-bottom plates.

Reconfiguring the Washer

Refer to the following table to find out what parts you should purchase and the steps you need to take to reconfigure the washer. The hardware and software steps are described on the following pages.

For ELX50/8, ELX50/12 and ELX50/8FMW

Note: If you have the ELx50/8FMW model, you can have either an 8-, 8s-, or 12-channel manifold. However, only the 8- and 8s-channel manifolds are compatible with the aspiration carrier.

If your current manifold is:	And you plan to use this manifold:	You need to:
12-channel	8- or 8s-channel	<ul style="list-style-type: none"> • Purchase the new manifold. • Perform the hardware steps. • Perform the software steps.
8- or 8s-channel	8s- or 8-channel	<ul style="list-style-type: none"> • Purchase the new manifold. • Perform the hardware steps. • Perform the software steps.
8- or 8s-channel	12-channel	<ul style="list-style-type: none"> • Purchase the new manifold. • Perform the hardware steps. • Perform the software steps.

For ELX50™/16

If your current manifold is:	And you plan to use this manifold:	You need to:
16- or 8-channel	8-, 8s-, or 16-channel	<ul style="list-style-type: none"> • Purchase the new manifold. • Perform the hardware steps. • Perform the software steps.

Hardware Steps

Refer to **Figures 7** through **10** in **Chapter 2** for installation of the manifold and microplate/aspiration carriers. Refer to **Figures 20** and **21** in **Chapter 2** for removal of the manifold and microplate/aspiration carriers.

To replace a washer manifold:

1. Remove the washer's mist shield.
2. Detach the tubes from the currently installed manifold.
3. Remove the thumbscrews (three if 16-channel manifold, otherwise two).
4. Lift the manifold up off the manifold support pins.
5. Orient the new manifold so that the tubes are pointed down, and the fittings are pointed toward the back of the washer.
6. Slide the manifold gently down over the support pins.
7. Replace the thumbscrews.
8. Replace the tubing.
9. Replace the washer's mist shield.

To replace the microplate carrier with the aspiration carrier:

1. Remove the microplate carrier.
2. Install the aspiration carrier.
3. Connect the aspiration carrier tubing.

To replace the aspiration carrier with a microplate carrier:

1. Disconnect the aspiration carrier tubing.
2. Remove the aspiration carrier.
3. Install the microplate carrier.

Software Steps

To specify an 8-, 12-, 8s-, or 16-channel manifold, follow the washer menu path shown below.

```
UTIL → SETUP → MANIFLD → SELECT MANIFOLD:  
8      12      8S      16 *
```

* 16 is not available on ELx50™/8FMW models.

To use the aspiration carrier:

1. Select 8 or 8S from the menu path above for the manifold.
2. Create an aspirate-only program and select BOT for the Aspirate Type.
3. Enter a Bottom Aspirate Time (BOT ASPIRATE TIME).

See **Chapter 3** for complete washer menu maps.

Appendix C

Chemical Compatibility

This appendix contains a name and materials listing of each ELx50™ component that will come into contact with chemicals dispensed during operation or maintenance. If there are questions about compatibility of chemicals with the ELx50, contact BioTek.

Components and Materials Composition	164
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Components and Materials Composition

Continuous contact with harsh chemicals is not recommended. It is best if the washer is rinsed with deionized water after contact with any strong acid, base, or solvent.

Components	Material Composition
Syringe seal, buffer bottle	Polyethylene
Fittings in bottles, inline fittings, check valves, waste bottle	Polypropylene
Check valve seals	Viton
Dispense tubes, syringe piston, check valve spring, carrier spring	316 SS
Syringe cylinder, carrier	Noryl (polyphenylene ether + polystyrene)
Manifold	CPVC (chlorinated polyvinyl chloride)
Manifold mounting bracket	Anodized aluminum
Assay plates	Polystyrene
Tubing, manifold bumpers	Silicone
Manifold seal, waste bottle stopper	EP (ethylene propylene)
Vacuum pump muffler	Body: Nylon; filter: borosilicate glass microfibers with PVDF Fluorocarbon Resin binder
Paint	Polyurethane

- ❖ The optional vacuum pump muffler (PN 4073009) is included with ELx50™ washers that are equipped with the new vacuum pump (washers manufactured after January 2008).

Appendix D

Default Programs

This appendix lists all default wash, prime, dispense, aspirate, and maintenance programs available onboard the ELx50™.

Default Programs.....166

Default Programs

	ELx50™/8	ELx50/12	ELx50/16	ELx50/8FMW*
WASH				
COSTAR_FLAT	X	X	X	X
COSTAR_FLT16_96	X	X	X	X
COSTAR_FLT16_384			X	
COSTAR ROUND	X	X	X	X
NUNC_FLAT	X	X	X	X
NUNC_FLT16_96	X	X	X	X
NUNC_FLT16_384			X	
NUNC_ROUND	X	X	X	X
PRIME				
Autoprime	X	X	X	X
NEW_BUFFER_PRIME	X	X	X	X
P_DAY_RINSE	X	X	X	X
P_DECON1	X	X	X	X
P_DECON2	X	X	X	X
P_RINSE_AND_SOAK	X	X	X	X
P_RINSE_LOOP	X	X	X	X
DISPENSE				
accuracy_qc_test	X	X	X	X
accur_qc_test384			X	
ASPIRATE				
residual_qc_test	X	X	X	X
resid_qc_test384			X	
MAINTENANCE				
DAY_RINSE	X	X	X	X
RINSE_AND_SOAK	X	X	X	X
OVERNIGHT_LOOP	X	X	X	X
LONG_SHUTDOWN	X	X	X	X
DECONTAMINATION	X	X	X	X

* **ELx50/8FMW model:** The microplate carrier for the ELx50/8FMW model should be installed when running any of the onboard programs. The aspiration carrier does not support these programs, and is specifically designed for bottom aspiration of filter-bottom plates.